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A COMPARISON OF THE MEAL, READY-TO-EAT, RATION, COLD WEATHER, AND RATION, LIGHTWEIGHT NUTRIENT INTAKES DURING MODERATE ALTITUDE COLD WEATHER FIELD TRAINING OPERATIONS

U S ARMY RESEARCH INSTITUTE
OF
ENVIRONMENTAL MEDICINE
Natick, Massachusetts

NOVEMBER 1988

UNITED STATES ARMY
MEDICAL RESEARCH & DEVELOPMENT COMMAND

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In January 1988, an 11-day field test comparing the Improved Meal, Ready-To-Eat (IMRE), the Ration, Cold Weather (RCW), and the Ration, Lightweight (RLW) was conducted during the second two weeks of a six week Marine Mountain Leaders Course taught at the Marine Corps Mountain Warfare Training Center, Bridgeport, CA. This testing site was selected because the environmental conditions and physical training regimen required substantial energy expenditures. Twenty-eight Marines, including instructors, were separated into three groups and consumed one of three rations exclusively for 11 consecutive days. The first five days were spent in the field, the 6th and 7th days in garrison and the final four days in the field. Both the RCW and RLW groups were required to carry their entire rations (5 days) into the field while the IMRE group was resupplied in the field midweek. Food and water intakes, hydration status, body weight changes, blood chemistries, and ration acceptability were recorded.

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Although all three groups lost a significant amount of body weight (3.3-4.4%), the differences between groups were not significant. The mean caloric intake (±SE) and macronutrient breakdown (% of energy intake) for days 2-11 were (3217±101 kcal 16.5% pro, 45.9% CHO, 38% fat IMRE); (2892±103 kcal; 13.1% protein (PRO), 56.7% carbohydrate (CHO), 30.2% fat RCW); and (3205±137 kcal; 13.6% PRO, 43.1% CHO, 43.5% fat RLW). The RCW and RLW groups consumed significantly less protein and sodium than the IMRE group. Adequate water was available; mean fluid intakes were 5.3±0.3, 5.3±0.3, and 4.7±0.2 L water/man/day for the IMRE, RCW, and RLW groups, respectively. The mean urine specific gravities for each ration group were below 1.030. These findings suggest that all three groups were adequately hydrated. The results indicate that all three rations were suitable for moderate altitude cold weather operations, however none proved to be superior to the others in reducing weight loss, or in increasing caloric or water intake. Both the RCW and RLW are less susceptible to freezing and are lighter in weight. These features recommend these rations for self-contained cold weather field operations where adequate water is available.

For these highly motivated, well equipped Marines all three rations were adequate to sustain field operations for 11 days in this type of moderate altitude, cold weather environment. As has been seen in other field studies, soldiers consumed insufficient calories to maintain their body weight and the approximately 1500 kcal/day caloric deficit observed cautions against the use of these rations beyond 10-14 consecutive days under conditions of heavy physical activity. Factors in addition to ration palatability and acceptance probably contribute to inadequate energy intakes and body weight loss. These factors should be identified and, insofar as possible, corrected. Ration palatability and acceptance could be improved by relatively minor menu modification, possibly increasing energy intake.

A COMPARISON OF THE MEAL, READY-TO-EAT, RATION, COLD WEATHER, AND RATION, LIGHTWEIGHT NUTRIENT INTAKES DURING MODERATE ALTITUDE COLD WEATHER FIELD TRAINING OPERATIONS

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Human subjects participated in these studies after giving their free and informed consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 in Use of Volunteers in Research.

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ABSTRACT

In January 1988, an 11-day field test comparing the Improved Meal, Ready-To-Eat (IMRE), the Ration, Cold Weather (RCW), and the Ration, Lightweight (RLW) was conducted during the second two weeks of a six week Marine Mountain Leaders Course taught at the Marine Corps Mountain Warfare Training Center, Bridgeport, CA. This testing site was selected because the environmental conditions and physical training regimen required substantial energy expenditures. Twenty-eight Marines, including instructors, were separated into three groups and consumed one of three rations exclusively for 11 consecutive days. The first five days were spent in the field, the 6th and 7th days in garrison and the final four days in the field. Both the RCW and RLW groups were required to carry their entire rations (5 days) into the field while the IMRE group was resupplied in the field midweek. Food and water intakes, hydration status, body weight changes, blood chemistries, and ration acceptability were recorded. Although all three groups lost a significant amount of body weight (3.3-4.4%), the differences between groups were not significant. The mean caloric intake (±SE) and macronutrient breakdown (% of energy intake) for days 2-11 were (3217±101 kcal 16.5% pro, 45.9% CHO, 38% fat IMRE); (2892±103 kcal; 13.1% protein (PRO), 56.7% carbohydrate (CHO), 30.2% fat RCW); and (3205±137 kcal; 13.6% PRO, 43.1% CHO, 43.5% fat RLW). The RCW and RLW groups consumed significantly less protein and sodium than the IMRE group. Adequate water was available; mean fluid intakes were 5.3±0.3, 5.3±0.3, and 4.7±0.2 L water/man/day for the IMRE, RCW, and RLW groups, respectively. The mean urine specific gravities for each ration group were below 1.030. These findings suggest that all three groups were adequately hydrated. The results indicate that all three rations were suitable for moderate altitude cold weather

operations, however none proved to be superior to the others in reducing weight loss, or in increasing caloric or water intake. Both the RCW and RLW are less susceptible to freezing and are lighter in weight. These features recommend these rations for self-contained cold weather field operations where adequate water is available.

For these highly motivated, well equipped Marines all three rations were adequate to sustain field operations for 11 days in this type of moderate altitude, cold weather environment. As has been seen in other field studies, soldiers consumed insufficient calories to maintain their body weight and the approximately 1500 kcal/day caloric deficit observed cautions against the use of these rations beyond 10-14 consecutive days under conditions of heavy physical activity. Factors in addition to ration palatability and acceptance probably contribute to inadequate energy intakes and body weight loss. These factors should be identified and, insofar as possible, corrected. Ration palatability and acceptance could be improved by relatively minor menu modification, possibly increasing energy intake.

INTRODUCTION

In a conventional war in Europe, the United States Marine Corps is tasked with the defense of NATO's Northern Flank, Norway. The likelihood of winter operations in this part of Europe is high; extreme cold places many added stresses on men, material, and equipment and may require special rations. Sub-zero temperatures and mountainous terrain contribute to operational difficulties as well. To be successful the ground combat element must maintain high performance levels despite environmental adversity.

A critical factor in individual Marine winter warfare combat effectiveness is his daily nutrient intake. His food must provide sufficient calories to support high levels of energy expenditure, contain the necessary macro- and micro-nutrients for proper physiological functioning, and be sufficiently palatable to ensure consumption. In addition, operational rations must be designed to withstand prolonged storage, shipping and handling abuse, and be as convenient as possible to prepare.

Two individual operational rations are currently available for issue: the Meal, Ready to Eat (MRE); and the Ration, Cold Weather (RCW). A third ration, the Ration, Lightweight (RLW) is in the final design stage and is expected to be available for issue by 1990 (see Appendix 1 for complete ration descriptions).

The MRE ration replaced the Meal, Combat Individual (MCI) as the Army's operational ration in 1984. To improve the acceptability and consumption of the MRE various changes have been introduced yearly. The newest version of this ration is the Improved Meal, Ready to Eat (IMRE) also known as the MRE VIII. This ration consists of 12 menus with entrees packaged in flexible retort pouches. Each meal weighs approximately 1.5 pounds with a volume of 90 cubic inches. The IMRE has 9

new and 2 reformulated entrees; 2 breakfast entrees were added; 8 oz portions replaced 5 oz portions for 10 entrees; fruit flavored beverage powder was included in all menus; hot pepper sauce in 4 menus; wet pack fruits replaced some dehydrated fruit; and commercial candies replaced military specification candies (1). A recent 11 day field test comparing the IMRE to MRE VII and MRE IV demonstrated that the latest MRE is a significant improvement over earlier versions for temperate sea level operations (1). The IMRE is approved to be the sole diet for up to ten consecutive days; the risk of menu boredom when used over a longer periods of time, though expected to be less than for the MCI, is presently unknown.

IMRE components are easier for the soldier to carry and handle in extreme cold than MCI components; however, frozen storage below 0° F is not recommended as rough handling may result in packaging failure. Freezing can be prevented by carrying the pouches next to the person to be warmed by body heat.

When properly manufactured and packaged, the IMRE can be expected to retain its serviceability up to three years under uncontrolled environmental conditions. Periodic surveillance inspection is required to confirm serviceability, with the frequency of inspection increased under adverse conditions. Under controlled conditions, a serviceable life of 100 months at 70° F or 55 months at 90° F can be expected.

The Marine Corps identified a need for a high energy non-freezing ration for cold weather operations (RCW). The Food Packet, Assault (FPA), type classified in March 1986 was the basis for the initial RCW concept. The RCW includes FPA food bars supplemented by components which provide extra calories and drink mixes to encourage water consumption. There are sufficient calories (4500) to sustain heavy physical exertion in an extreme cold climate. The sodium and protein content are adequate but limited to reduce the daily physiological water requirement and prevent symptoms of dehydration. The RCW also contains relatively high amounts of carbohydrate to replace muscle glycogen and provide an ample supply of readily available energy.

There are six menus of freeze dehydrated, compressed entree bars and other low moisture foods in each case of RCW's. The ration was designed to provide the Marine Corps with lightweight, compact, high caloric subsistence for assault, reconnaissance, and other non-resupply operations under frigid conditions. Each RCW consists of two flexible pouches with a total weight of 2.75 pounds and a volume of 225 cubic inches. The low-moisture foods make the components suitable for use in extremely cold weather as there is virtually no moisture to freeze. A minimum total of 98 ounces of water is required to rehydrate all components of the ration. The items may be eaten without rehydration but certain components such as the beverage powders and entrees are not very palatable in this form.

The RLW is a very lightweight and compact ration (2000 kcal, 1.0 pounds, 37 cubic inches) which was designed to subsist Special Operations Forces in surveillance and reconnaissance operations for up to 30 days without resupply. If issued two rations per day, as was done in this field test, it is still considerably lighter and more compact than either the IMRE (4/day) or RCW (1/day) rations (4000 kcal, 1.9 pounds, 74 cubic inches; RLW 2/day). The RLW consists of lightweight, low volume, calorie dense food items which are palatable and convenient to use.

Each RLW is packaged in a vacuum shrunk rectangular package inserted into a cardboard box. A separate accessory packet (8.3 ounces, 25 cu. in.) containing ice tea mix, sugar, coffee, utensils, etc can be issued on the basis of one per six days. All ration components can be eaten dry; some can also be rehydrated. The ration weighs less than one pound (not including the accessory packet) and 30 are packed into a case. It is essentially an energy restricted ration for use of up to 30 days under conditions of light to moderate levels of physical activity.

There are six menus of dehydrated and intermediate moisture items that are fortified with vitamins and minerals, high in calories and freeze resistant.. These include entree bars, bread crisps, dairy bars, cereal bars, beverage bars, beef jerky, and

dessert bars. Six flavors are available in all components except beef jerky. A ration summary is shown in Table 1.

Although numerous field tests have been completed to evaluate each of these packaged rations (1-9) they have not been compared against each other in a cold, moderate altitude environment. This study was conducted in an attempt to determine which, if any, of these three operational rations best sustains the individual Marine's physical performance during tactical operations in snow-covered mountainous terrain. The results of this test were also expected to provide information on the utility of the RLW ration in a cold environment. A ration that is clearly superior for cold weather use will enhance combat effectiveness and limit performance degradation of the ground combat element during hostilities.

The field ration test was conducted during the second two weeks of a six week Winter Marine Mountain Leaders course (MLC) at the Marine Corps Mountain Warfare Training Center (MCMWTC) Bridgeport, California. This testing site was selected because of the training regimens and environmental conditions which require substantial energy expenditures. The data collection schedule is summarized in Table 2.

METHODS

Test Subject

Instructors and students of the Marine Mountain Leaders Course (MLC) were briefed on the purpose of the field ration test and the risks and benefits involved. This study was approved by the USARIEM and USAMRDC/OTSG Human Use Review Committees. Test subjects were briefed and given informed volunteer consent agreement forms (Appendix 4) to sign and instructed that they could withdraw from the study at any time without penalty or loss of benefits.

Twenty-eight marines volunteered to take part in this 11 day study. Squads had already been formed prior to the beginning of the test so groups were randomly assigned to one of three experimental rations. Non-participating students were reassigned to the Improved Meal, Ready-To-Eat (IMRE) squad but ate the standard Meal, Ready-To-Eat (MRE V). Eight subjects were assigned to the IMRE which was used as the control ration; 10 subjects were assigned to the Ration, Cold Weather (RCW); and 10 subjects were assigned to the Ration, Lightweight (RLW). Subject #17 from the RCW group was called back to regular duty on day eight and had to withdraw from the study. His data is not included in this technical report. All test subjects were experienced Marines averaging 6.9 years active military duty. The physical characteristics of the ration groups are listed in Table 3.

Operational Scenario

The field ration test was conducted during the second two weeks of a six week Winter Marine Mountain Leaders course (MLC) at the Marine Corps Mountain Warfare Training Center (MCMWTC) Bridgeport, California in January 1988. The Winter MLC is designed to bring selected Marines to a high standard of technical and tactical expertise in the basic and advanced skills required for the successful conduct of

operations in the cold weather/mountainous environment. Additionally, the course prepares the graduate to function as an instructor and advisor to his unit in a variety of areas to include military skiing, bivouac routine, survival skills, avalanche avoidance and rescue, and mountain navigation. The six week course has a student capacity of 40 with a cadre of 8 instructors.

The MCMWTC training area has 50,000 acres of semi-arid, mountainous terrain on which to conduct field training exercises. The training area also includes parts of the Toiyabe National Forest. The terrain was snow covered with an average depth of approximately 3 feet. The temperatures ranged from a low of +5° F to a high of +55° F.

During the first week of the study soldiers were transported by tracked vehicle (LMC, DMC, and BV) to Grouse Meadow training area (8,353 feet). Training started with the establishment of bivouac areas and ski and snowshoe training. On days 2 and 3 soldiers relocated bivouac areas, completed numerous displacements on skis and snowshoes (day and night) and stood sentry duty (60 min shifts). On day 4 a 6 km ski race and night land navigation exercises were conducted. On day 5 the classes skied 10 km back to base camp (7,218 feet).

During the weekend students and instructors were free to do as they wished but agreed not to consume any food items and/or beverages other than what was issued to them. Trading of ration components was permitted within ration groups but not between ration groups.

During the second week soldiers were deployed by helicopter to another training area, Sardine Meadow (7,243 feet). The classes then set up bivouac areas, participated in reconnaissance patrols, and completed a 10 km biathalon. On day 11 the classes returned by helicopter to base camp. A detailed training schedule can be found in Appendix 2.

Fresh water was delivered to the subjects from the training center to assure a consistent supply for other testing purposes. Despite the availability of fresh water the Marines utilized melted snow for approximately 67% of their water requirements. This was part of their training exercise and was done 1 to 3 times per day. Subjects used both squad stoves and personal stoves to complete this task.

The IMRE group was resupplied with rations midweek due to the bulky nature of the ration. The RCW and RLW groups carried all rations (for 5 days at a time) with them into the field. Pack weights were taken at the beginning of each week. All three ration groups started with a pack weight of approximately 23 kg.

RATIONS

Table 1 shows macronutrients, weight and volume of the IMRE, RCW, and RLW rations. Nutrient composition data, menu descriptions and information papers on all three rations issued can be found in Appendix 1.

The IMRE was used as the control ration. It consists of 12 menus the entrees of which were packaged in a flexible retort pouch with each meal weighing approximately 1.5 pounds with a volume of 90 cubic inches. Test subjects were issued four IMRE meals per day which supplied approximately 5200 kcals. Due to the bulky nature of this ration (approximate total 6.0 lbs; 360 cubic inches/day) subjects were resupplied mid-week while in the field.

Test subjects were issued one RCW ration per day which supplied approximately 4500 kcals. Subjects were not resupplied out in the field and were required to carry their whole ration allotment with them (approximate total 2.75 lbs; 225 cubic inches/day).

Two RLW rations were issued per subject per day providing approximately 4000 kcals/man/day. Test subjects were required to carry all their rations for one week into the field (approximate total 1.9 lbs; 74 cubic inches/day).

Food and Water Intakes

Each subject was issued two pocket sized (approx. 6x8") log books which corresponded to his ration type (IMRE, RCW, RLW). These were then used to self-record, daily food and fluid intakes as well as other information not presented in this technical report. The first log book contained days 1-5 and the second log book contained days 6-11. See Appendix 3 for an example of the log books used by each ration group. Log books similar to these have been used in past ration tests and give reliable results (2).

Trained dietitians instructed all subjects on how to accurately record the food and fluid data in the log books. Marines selected a food item that they had just consumed and then circled the quantity of the food item consumed (1/4, 1/2, 3/4 or 1). If the subject had more than 2 of any item or less than 1/4 he was instructed to write down the amount consumed in a separate column. The amount of water used to rehydrate a food item was recorded in terms of canteen cups (660 ml) and drinking water was recorded in terms of canteens (960 ml). Total water intake was calculated by summing the amount of water used to rehydrate food and beverage items, the amount of water consumed from drinking, and the moisture found in the ration products themselves. On day 6 and at the end of the study period test subjects were interviewed by the same dietitian to determine the accuracy and completeness of the entries recorded.

On day 1 of the study subjects ate a type A-ration for breakfast, after which they ate only the rations that were issued to them. Grand mean nutrient shown in this report values excluded day 1 for this reason. Subjects were told they could trade food items within ration groups if they recorded exactly what they had eaten. They were, however, not permitted to trade between ration groups. As a check for compliance subjects were instructed to save food wrappers and uneaten portions of food in a ziplock bag on day 10 of the study. These food wrappers were then

inventoried as a check against log book entries. Wrappers collected that had no corresponding log book entry were noted but were not used to adjust food intake records.

Nutrient Intakes

Nutrient intakes were calculated by factoring individual food items consumed against known macro- and micro-nutrient values. These food composition tables were provided by Natick Research Development and Engineering Center and were entered into a nutrient factor file. Data reduction was done on a Digital VAX 780 computer using a nutrient analysis system developed by USARIEM (4). Nutrient intakes reported for this study include kilocalories, protein, carbohydrate, fat, vitamin A, vitamin D, vitamin E, ascorbic acid, thiamin, riboflavin, niacin, vitamin B_6, folacin, calcium, phosphorous, magnesium, zinc, iron and sodium. Group mean nutrient intakes were compared to the Military Recommended Dietary Allowances (MRDA) found in AR 40-25 (10).

Ration Acceptability

Included in the log books were scales for hedonic rating of food items and reasons for not finishing a food item (Appendix 3) (11). Food items consumed were rated by circling a number form 1-9 which corresponded to "disliked the ration item extremely" (No. 1) to "liked the ration item extremely" (No. 9). Various reasons for not finishing a food item were provided, if these did not fit the subjects description, he was instructed to write down one that accurately described his reason. This data was used to focus the attention of the subjects on assessing each individual food item. Hedonic ratings and reasons not eaten will not be reported in detail in this report due to the relatively large N required to lend validity to this type of data. The results collected will be discussed insofar as they contribute to general test subject perception of the rations.

At the conclusion of the test, each Marine was given a final questionnaire; a different version for each ration group (IMRE, RCW, RLW). The questionnaires were

designed to elicit from each test subject a personal evaluation of ration acceptability, human factors, and subjective performance with the ration under field conditions as described above. Acceptance was measured using the nine-point hedonic ratings scale. Upon completion of the questionnaire each subject was interviewed and the questionnaire checked for proper completion. All subjects thoroughly completed the questionnaire and appeared to give serious consideration to their answers. However, because the ration groups were small (8-10 men) one subject's extreme personal preference could have easily skewed the group's mean response. The responses discussed should not necessarily be interpreted as being representative of responses that would be found in other populations of test subjects; these results are only an indicator of what might be expected under similar circumstances with similar test subjects.

Anthropometry

Height was measured in stocking feet standing on a flat surface with the head held horizontal. Body weight was measured in T-shirt, PT-shorts and stocking feet using a calibrated digital electronic battery powered balance accurate to ±0.1 lb (SECA Model 770). Scales were calibrated before use using six 11.9 kg lead calibration bricks. Each scale was set on a plywood board to provide a more stable, level surface. Weights were taken at three points during the study (pre-experiment, day six and post-experiment). Percent body fat was estimated according to the standard military method of taking circumference measurements (12). Three measurements of the abdomen (below the navel) and neck (below the larynx) were taken sequentially pre- and post-experiment by the same individual. Percent body fat was then calculated using a formula devised for the Army's Weight Control Program (13).

VO_2 max Determination

Subjects were tested for maximal aerobic capacity (VO_2 max) pre and post experiment. VO_2 max was determined using a metabolic cart and a cycle ergometer stress test. Test subjects were required to pedal on a cycle ergometer at 75 revolution per minute (RPM) at a work load of 37.5 watts. The work load increased by 37 watts every 3 minutes (225 $rpm \cdot min^{-1}$) until the subject was unable to continue or the pedal rate fell below 70 RPM. VO_2 max was determined using a computerized metabolic chart (Sensor Medics MMC-Horizon, Anaheim, CA). The pre-test VO_2 max values are reported in Table 3 of this technical report to help characterize the physical condition of the test subjects. A full discussion and comparison of pre and post VO_2 max values can be found in the report by Hoyt et al. (14).

Blood Chemistries

Venous antecubital blood samples were taken after an overnight fast pre- and post experiment. Blood samples were collected in Na+EDTA tubes, centrifuged, aliquoted and the plasma stored in liquid nitrogen (-70° C). Plasma was analyzed for glucose, BUN/urea, triglycerides, and cholesterol using a commercial analyzer (KODAK EKTACHEM DT60 Analyzer, Rochester, NY).

Hydration Status

Eight first void morning urine samples were obtained from each subject during the course of the study. The urine samples were analyzed by trained laboratory technicians for specific gravity using a refractometer accurate to ±0.001 units (American Optical Model 10400A). Urine specific gravities of 1.030 or higher are indicative of a sub-optimal hydration status (15).

Statistical Methods

All results are expressed as mean±SEM. A P value of less than 0.05 was considered to be statistically significant. Body weight changes, body fat changes, VO_2

max values and wrapper collection data were tested by a paired t-test (16). Nutrient intakes were analyzed by a 2-way ANOVA with repeated measures for days 2-11 (16). When significant differences were found, a Student-Newman-Keul post hoc test was performed to distinguish between ration groups.

RESULTS

Physical Characteristics

Table 3 summarizes the physical characteristics of the three ration groups (mean±standard error) according to age, height, weight, body fat percent, VO_2 max in liters per minute, and milliliters per kilogram per minute. There were no significant differences between ration groups on any of these parameters. The average age of the subjects was 27.2 years; height 70.2 centimeters; weight 81.2 kilograms; and body fat 20 percent. All test subjects were experienced Marines averaging 6.9 years active military duty.

Body Weight and Percent Body Fat Changes

Body weight changes (mean± standard error) are shown in Figures 1 and 2. All three ration groups lost a significant amount of body weight (3.3% IMRE, 3.4% RCW, 4.4% RLW). OTSG guidance suggests that troops should not lose more than 3% of their initial body weight during field operations (4). None of the three groups met this limit. There were however, no significant differences in weight loss between ration groups (-2.1±0.4 kg IMRE, -2.3±0.5 kg RCW, -2.8±0.4 kg RLW). It is difficult to determine the composition of the weight loss (i.e. water, body fat and/or lean muscle mass). Some body weight loss is probably due to water loss but the exact amount is unknown. Fat loss determined by the circumference technique accounted for approximately 48-90% of the total weight loss.

Percent body fat change can be seen in Figure 3. The IMRE and RLW groups lost significantly more body fat than the RCW group (1.9±0.2% IMRE, 0.9±0.4% RCW, 1.6±0.3% RLW).

Mean pack weights are shown in Figure 4. There were no significant differences in pack weights between ration groups. It should be noted, however that

the IMRE group was resupplied, due to the bulky nature of their ration, mid week whereas the RCW and RLW groups were not. Mean semi-nude weight, dressed weight with weapon, and weight with weapon and pack for each ration group are shown in Figure 5.

Fluid Intake, Specific Gravity and Hydration Status

Fluid Intakes

Total water intake is computed from three sources: the water contained in the ration, the water added to the ration including the beverage mixes, and the plain water drunk, usually from a canteen. Figure 6 shows the mean water intake from each source. Table 4 lists the mean±standard error for each source. The RCW and RLW rations contain significantly less water than the IMRE as is expected from dehydrated rations. The RCW group added more water to their ration than either the IMRE or RLW groups. All three groups drank relatively the same amount of water. Mean total water consumption is shown in Figure 7. The RLW group tended to add less water to their ration but drank more plain water. The increase in drinking water for this group was not great enough to offset the reduced amount of water added to the ration. The RLW groups water intake was slightly less than that of either the IMRE and RCW group (5273±302 ml IMRE; 5277±255 RCW; 4687±170 RLW). This was not statistically significant. As can be seen in Figure 8, each group had a high degree of variability in their total daily water intake (especially the RCW group who on the last day of the study consumed only two-thirds of their usual intake).

Specific Gravity and Hydration Status

Mean urine specific gravities and total water intakes for each ration group over the course of the ration test are plotted in Figures 9. The average urine specific gravities for each ration group never exceeded 1.030, although there were individuals who where above this criterion. Specific gravities above 1.030 are considered elevated and are indicative of possible dehydration (15). Table 5 shows the number of

individuals in each group who had urine specific gravities above 1.030 (5% IMRE; 11% RCW; 16% RLW) and the specific days that these incidences occurred. Urine specific gravities prior to deployment for all three groups were approximately the same (1.019 IMRE, 1.018 RCW, 1.019 RLW). Throughout the ration test the RLW group tended to have higher specific gravities and lower total water intake than either the IMRE or RCW groups.

Blood Chemistries

Blood chemistries are presented in Table 6. Blood glucose, which is regulated over a narrow range of 70-105 mg/dl, was found to be within normal limits pre- and post experiment for all three groups (15). Blood urea nitrogen, which occurs over a normal range of 7-18 mg/ml, was found to be elevated post experiment (15). This occurs secondary to increased protein breakdown which can be caused by any or all of the following: starvation, stress, or dehydration (15). This increase was significant in the RLW group. Normal triglyceride values fall in the range of 30-160 mg/dl (15). All three ration groups experienced a drop in triglyceride values; however, they were within the normal range cited. The decrease was significant in the RLW group. The Adult Treatment Panel of the National Cholesterol Education Program states that a blood cholesterol level <199 mg/dl is considered desirable, 200-239 mg/dl borderline high, and >240 mg/dl high (18). Increased levels of cholesterol are associated with atherosclerosis and coronary disease. The mean cholesterol value for all subjects pre-experiment was 183±4.4. Twenty-eight percent of the subjects had blood cholesterol values greater than 200 mg/dl.

Comparison of Wrapper Collection vs. Log Book (validation)

Log book records were found to be slightly more complete than the wrapper collections. Wrapper collections were quantitated in kilocalories and averaged 94.0 percent of log book entries (3498 kcal wrapper collection, 3717 kcals log book entries). This was not statistically significant. Values reported for mean caloric consumption are

greater because the time wrappers were collected. day 10. subjects on average consumed a greater quanity of their ration (see Figure 10).

Nutrient Intakes

The average daily nutrient intakes compared to MRDA requirements are presented in Table 7.

Macronutrients

Average daily nutrient intakes for calories. protein. fat and carbohydrate for each ration group are shown in Figures 10-13. Mean nutrient intakes for days 2-11 compared to the MRDA for kilocalories. protein. carbohydrate. and fat are shown in Figure 15.

Daily caloric intakes were variable between study days for all three groups. Mean caloric intakes for days 2-11 were 3217 kcal ± 101 for the IMRE group. 2892±103 for the RCW group and 3205±137 for the RLW group. These differences were not statistically significant. All three ration groups had their complete ration allotment available to them in the field. The IMRE group was issued 5192 kcals/day and consumed 62%; the RCW group was issued 4470 kcals/day and consumed 65%; and the RLW groups was issued 4219 kcals/day and consumed only 76%. All three groups consumed less than the Military Recommended Dietary Allowance (MRDA) for soldiers in a cold environment 14° C (57.2° F) wearing heavy. cold weather clothing and footgear and maneuvering for prolonged periods on foot. snowshoes. and skis. The MRDA requires a 25% increase in total calories (4500 kcals/day) above that which supports soldiers who are moderately active and living in a temperate climate (10).

Daily protein intakes were generally lower for the RCW groups compared to the IMRE and RLW groups. Mean protein intakes were 133±3.8 g (16.5% total kcals) for the IMRE group. 95±2.7 g (13.1% total kcals) for the RCW group. and 109±3.7 g (13.6% total kcals) for the RLW group. Both the IMRE and RLW groups met the MRDA for protein which is 100 g/day. the RCW group consumed slightly less. They

did however, exceed the NAS/NRC RDA of 56 g/protein/day (17). The IMRE group consumed significantly more protein than the RLW group. The RCW group consumed significantly less protein than either the IMRE or RLW groups. The reduced protein content of the RCW was designed to ease the water burden required for nitrogen excretion.

Mean fat intakes for all three groups were below the 160 g/day maximum recommended by the MRDA (136±4.6 IMRE; 97±4.2 RCW; 155±8.1 RLW g/man/day). The RCW group consumed significantly less fat than either the IMRE or RLW groups. Also, the RLW group consumed significantly more fat than the IMRE group. The percent of kcals from total dietary fat was 38.0% IMRE; 30.2% RCW; and 43.5% RLW.

All three groups consumed approximately the same amount of carbohydrate (367±12.4 IMRE; 410±15.4 RCW; 345±14.7 RLW g/man/day respectively). These values were not significantly different. Although there is no MRDA for carbohydrate the nutritional standards for operational and restricted rations (NSOR) does set a 440 gm/day (desired content) and 100-200 gm/day (minimum content) criteria for evaluation purposes. The IMRE and RCW are considered operational rations and fully meet the content criteria of 440 gm/day. The RLW is considered a restricted ration (usually issued on a one-per-day basis) and has to meet the 100-200 gm/day criteria. When issued on a two-per-day basis as was done in this study it just falls short of meeting the operational ration criteria. A diet high in carbohydrate contributes approximately 50 to 55 percent of the total dietary energy (10). Carbohydrates contributed 45.9% of the total kcals to the IMRE; 56.7% total kcals RCW; and 43.1% total kcals RLW. Mean total sodium consumption and milligrams sodium per 1,000 calories are shown in Figure 15. The RCW group consumed significantly less sodium than either the IMRE or RLW groups and the RLW group consumed significantly less sodium than the IMRE group (5803±184 IMRE; 3531±107 RCW; 4533±159 RLW

mg/man/day). The nutritional standard for operational rations for sodium is 5000-7000 mg/day or 1700 mg of sodium/1000 kcals. The IMRE group received 1800 mg sodium/1000 kcals, RCW 1220 mg sodium/1000 kcals, and RLW 1400 mg sodium/1000 kcals. Both the RCW and RLW rations were designed to contain lower but adequate amounts of sodium to reduce the water required for sodium excretion in the urine.

Mean nutrient intakes for thiamin, riboflavin, niacin, ascorbic acid, vitamin B6, vitamin A, iron, magnesium, calcium, phosphorus, and potassium are shown in Figures 16-18. All of the RLW group's vitamin and mineral intakes were above the MRDA because each 2000 kcal ration is fortified to meet the MRDA (Table 7). The IMRE group met the MRDA for all nutrients except folacin and magnesium; the RCW group met the MRDA for all nutrients except protein, riboflavin, folacin, calcium, iron, and zinc.

Food Item Selection and Consumption

Percentage of the IMRE, RCW and RLW eaten vs. issued is presented in Figures 19-26. This data was not subjected to statistical analyses and is presented to aid in determining which ration components were not consumed as well as others. This type of data may be useful in identifying potential food components that could be replaced by ones that might be consumed at a higher rate. Consumption data may or may not correspond to hedonic ratings since food consumption is influenced by other variables than taste, smell and textures such as ease of preparation, time for eating, and availability of water for hydration.

On the average most of the IMRE entrees were consumed between 65-75 percent of the time with the chicken with rice and ham with potatoes being consumed ~100 percent of the time. Mean entree consumption was 74%. The starch products (crackers and potato) were consumed in similar amounts. Mean starch consumption was 61%. Out of the spreads category the cheese was consumed at the highest rate (78% cheese; 40% jelly; 54% peanut butter). Mean spreads consumption was 55%.

The beverage base powder and cocoa powder were consumed at the same rate. Mean beverage consumption was 57%. The wet packed fruit was consumed at a higher rate than the dehydrated fruit (67% applesauce; 50% dehydrated fruit). Mean fruit consumption was 55%. The chocolate nut cake and chocolate covered cookie were consumed more often than the maple nut cake and cherry nut cake (61% oatmeal cookie; 83% chocolate covered cookie; 72% chocolate covered brownie; 22% cherry nut cake; 47% maple nut cake; 92% chocolate nut cake). Mean desserts consumption was 64%.

The RCW chicken-ala-king and pork and escallop potatoes entrees were consumed more often than the beef and vegetable bar (83% chicken stew; 69% beef and vegetable; 100% pork and escallop potatoes; 100% chicken-ala-king; 89% chicken and rice; 89% spaghetti with meat sauce). Mean entree consumption was 88%. All three hot cereals were consumed in similar amounts. Mean hot cereal consumption was 87%. The RCW desserts were consumed in similar quantities except for the fig bar and blueberry bar which were consumed slightly more often (57% granola bar; 53% oatmeal cookie bar; 63% nut and raisin mix; 76% fig bar; 78% blueberry bar; 58% chocolate covered cookie bar; 55% brownie; 63% chocolate toffee bar). Mean dessert consumption was 62%. The ice tea and chicken noodle soup had a higher consumption rate than either the orange beverage bar or strawberry/raspberry soups (46% cocoa; 64% ice tea; 50% cider; 34% orange beverage bar; 66% chicken noodle; 39% strawberry soup; 31% raspberry soup). Mean beverage consumption was 49%.

The RLW beef stew (98%) and chili (93%) entrees were consumed slightly more than chicken-ala-king (73%), pork and rice (80%), chicken and rice (79%), and beef jerky (73%). Mean entree consumption including beef jerky was 79%. The malted wheat granules and corn flakes bars were consumed in similar amounts (~92%) whereas the shredded wheat bars and oat cereal biscuits were consumed in lesser amounts (~60%). Mean cereal bar consumption was 73%. In this field test the bread

crispy product was not well received. The bacon and cheese and coconut bread crispies were consumed in similar amounts (~58%). The nacho flavored bar was consumed the least (23%). Mean bread crispy consumption was 44%. The RLW chocolate chip, halva chip, and graham dessert bars were consumed more often than either the pecan pie and blueberry bars (58% apple cinnamon; 48% blueberry; 74% chocolate chip; 98% halva chip; 46% pecan pie; 100% graham). Mean dessert consumption was 68%. The banana dairy bar was the most often consumed dairy bar with the orange pineapple, and strawberry dairy bars being the least consumed (65% almond, 56% orange pineapple, 60% mixed nut, 53% strawberry, 94% banana, 73% vanilla). Mean dairy bar consumption was 66%. The strawberry, raspberry and lemon-lime beverage bars were more often consumed than the tropical punch bar (58% cocoa; strawberry 75%; 63% orange; 53% tropical fruit punch; 68% lemonade; 74% lemon lime; 77% raspberry). Mean beverage bar consumption was 63%.

Ration Acceptance

At the conclusion of the test each Marine was given a final questionnaire to elicit personal evaluation of his experience with his assigned ration under cold weather field conditions. Upon completion of the questionnaire each subject was interviewed and the questionnaire checked for proper completion. All subjects thoroughly completed the questionnaire and appeared to give serious consideration to their answers. However, as the ration groups were small (8 to 10 men each), the results lacked statistical validity and should serve as an indicator of what may be expected under similar circumstances with other test subjects. Food items were rated on the following nine point scale:

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE
1	2	3	4	5
LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY	
6	7	8	9	

IMRE entrees were well liked with acceptance ratings from 6.38 to 8.38. Test subjects also found the starch and spreadable products very acceptable (6.88 to 8.50). Dehydrated fruits earned adequate ratings of 5.63 to 6.67 with the one wet pack fruit rated at 8.25. Dessert ratings ranged from 4.47 to 8.50; all beverages and candy items were acceptable at the 8.00 level or higher.

As a group the RCW entrees received high hedonic ratings from a low of 6.00 to more than 8.00. The three varieties of oatmeal, which may be considered breakfast entrees, rated exceptionally well at 7.80 or higher.

There are eight beverages in the RCW to encourage fluid consumption: Most were well accepted with ratings from 5.56 to 8.20. Nine ready-to-eat snack foods grouped in the category "Other" were rated from 4.25 to 8.20.

The RLW, although not designed for this type of activity and environment, was generally well accepted. The lowest rating for an entree was 6.10 with a high of 8.00. The six varieties of Bread Crisps were disliked within a narrow range from 1.90 to 2.78. Dessert Bars were moderately well accepted from a low of 4.90 to 7.63. Dairy Bars received similar though somewhat lower acceptance ratings (5.50 to 6.88). Cereal Bars, which can be eaten dry or mixed with Dairy Bars were well liked (6.67 to 7.33).

The various RLW beverages received excellent ratings with a low of 7.40 and a high of 8.50. Unlike Chewing Gum (8.33), which is found in all rations, Beef Jerky is a component found only in the RLW and scored an exceptionally high 8.50.

Water was generally available for drinking, ration rehydration and preparation. Test subjects obtained water from five gallon water cans when available, or by melting snow. Several Marines usually combined efforts to produce water for the group using personal or squad stoves. Water availability was not considered a major problem during the field exercise.

IMRE and RCW groups felt that they almost always ate enough; the RLW group tended to be somewhat hungry. However most subjects, including those that complained of hunger, usually did not consume their entire ration. Lack of time to prepare a meal was the most commonly cited reason for incomplete consumption.

Opening meal envelopes and component packaging was slightly difficult when wearing gloves. Preparation instructions were clear and easily followed and almost all heatable items were consumed hot.

Overall, the three different rations were well accepted with some minor component exceptions. Consumption was occasionally constrained by lack of preparation time or water availability. Most individuals stated they could subsist solely on their assigned ration for an extended period (usually stated as "30 days" to "indefinitely") if necessary.

DISCUSSION

Energy Balance

All three ration groups consumed inadequate calories (3217±101 IMRE; 2893±103 RCW; 3205±137 RLW) to meet the high energy demands of this field exercise. This is reflected in the 3.3-4.4% body weight loss incurred. It is difficult to determine what type of weight was lost (i.e. fat, lean muscle mass, and/or water). The best estimates indicate approximately 63% was fat loss. Water discipline was encouraged both by command and by the research team. Dehydration could possibly have resulted in weight loss; however, the majority of test subjects were shown to be adequately hydrated at the end of the study. No one ration proved to be superior to the others in maintaining body weight. It has been suggested by some investigators that although these rations probably contain enough calories to prevent weight loss in the field (5200 IMRE; 4500 RCW; 4000 RLW) soldiers do not consume adequate amounts to maintain their body weight because of "environmental and/or situational factors" (1). These factors have been demonstrated to be a problem in other cold weather field exercises and include the following: the inability to heat or rehydrate a ration during cold weather due to the lack of a stove or time to melt snow; the lack of specific meal times in which to consume the ration; and the inability to carry the total ration issued out into the field (2,6). Although these were cited as problems in other field tests our subjects obtained 30% of their water from 5 gallon containers provided for their use and all were able to melt snow which constituted 65% of their water supply. Also, Marines indicated that they ate at specific meal times imposed by command and continued consuming foods throughout the day, as time permitted.

It is clear that other factors affect the soldier's ability to meet their caloric requirements. It is well documented that physical and psychological stress have an

adverse affect on appetite (19). When successive days of field training and/or lengthened physical working times are required, soldiers often lack the appetite to compensate for their higher energy expenditures. Possible causes for decreased caloric intake include menu boredom, inability to work on a full stomach, decreased appetite due to increased exercise, and anxiety due to field conditions.

The literature shows that lower environmental temperatures do not increase metabolic rates in adequately clothed men who are working or exercising in a cold environment during the day (20). Calculation of energy expenditures during similar field exercises have shown that increased energy expenditure is due to the bulkiness of cold weather clothing; weight carried on the torso (pack) and feet (boots, snowshoes, or skis); the march or skiing rate, type of terrain traversed; and means of mobility (skiing, snowshoes, walking) (20). A rough estimate of energy expenditure, based on an activity log (time spent doing light, moderate, and heavy work/exercise) and weight loss, was approximately 4,500 kcal/man/day. Caloric intakes were 69% of this estimate which were approximately 1400 kcals/day below energy demands. The energy intakes with this study, although lower than recommended, were slightly higher than other studies where the IMRE and RCW were fed. Roberts et al. (7) reported a 2751 kcal/day intake for Special Forces soldiers on a 10 day winter field training exercise. This investigator also reported energy intakes of 2525 kcal/day for light infantry soldiers on a cold weather FTX in Alaska (21). Popper et al. (1) reported an intake of 2842 kcals/day for soldiers consuming the IMRE on a 11 day field exercise working in a temperate climate.

Hydration Status

The IMRE and RCW groups consumed approximately the same amount of water (5273±302; 5277±255 ml, respectively) with the RLW groups consuming 89% of this (4687±170 ml). Urine specific gravities showed that the majority of test subjects were well hydrated. However, on occasion (5% IMRE; 11% RCW; 16% RLW) soldiers

had urine specific gravities above 1.030. Unlike other cold ration field tests, subjects had adequate water available to them through water provided in 5 gallon containers (35% of total) and by melting snow (65% of total).

The protein and sodium content of the RCW ration although adequate, was intentionally reduced to limit the daily physiological water requirements. End products of protein metabolism and/or a dietary surplus of sodium are excreted in the urine. Normal adults excrete between 1000 to 2500 ml of urine with a specific gravity of 1.016 to 1.022 during a 24-hour period (15). The normal kidney has the ability to concentrate urine to a minimum of 400 to 600 ml/day or a specific gravity of 1.030 (15). Urine specific gravity after an overnight fast are approximately 1.026 (15). Urine consists of approximately 95% water and 5% solids. Solids are composed of urea (20%), sodium chloride (25%), sulfate, and phosphate (15). Urea is directly related to the quantity of protein consumed and/or the rate of protein catabolized and represents more than 80 to 90% of the total urinary nitrogen (22). Increased protein intake will increase the minimum urine volume needed to eliminate nitrogenous waste products. Calculation of the amount of water saved by reducing the protein and sodium content of the RCW and RLW ration are as follows: for every gram of urea nitrogen excreted approximately 50 ml of water are required (23). The RCW and RLW groups consumed significantly less protein (38 and 24 gm/day, respectively) and consequently, less nitrogen (6.1 and 3.8 gm/day, respectively) than the IMRE group. Therefore, the RCW group would require 305 ml and the RLW 190 ml less water than the IMRE group for nitrogenous waste disposal. The body requires 300 l of water to excrete 1 gm of sodium (24). The RCW group consumed 2272 mg and the RLW group 1270 mg less sodium than the IMRE group. This resulted in a savings of 682 ml H_2O/day for the RCW group, and 381 ml H_2O/day for the RLW group. The combination of reducing the protein and sodium content of the rations lowered the water requirement for the RCW group by 987 ml and the RLW group by 571 ml. It

can be concluded that the two dehydrated rations saved approximately enough metabolic water to compensate for their lack of food source water (the IMRE ration contains 600 ml of food source water).

Nutritional Status

A high carbohydrate diet is known to have beneficial effects on exercise performance, especially during successive days of prolonged endurance training. After prolonged activity at moderate intensity (60-75% VO_2 max) glycogen stores in the exercising muscles and the liver are considerably depleted. This leads to exhaustion, which is described as, "an inability to continue exercise at the same intensity level" (25). Costill et al (26) found that during repeated days of endurance training only a small restoration of muscle glycogen was observed when subjects were fed a mixed diet containing 250 g of CHO/day. When subjects were fed a high carbohydrate diet containing 550-600 g/CHO/day muscle glycogen stores were restored within the 22 hours between training sessions. Consumption of 150-650 g of carbohydrate per day resulted in proportionately larger increases in muscle glycogen stores but more than 650 g per day was not beneficial (27).

Costill et al. (28) also observed that a high carbohydrate diet (>500 g/day) required many subjects to consume more kilocalories to become satiated than they would have otherwise. As was seen in our study, the subjects underestimated their caloric needs and entered into a negative caloric balance which ultimately provided too little carbohydrate for full muscle glycogen repletion.

Although the IMRE group had 644 gms/CHO/day available they only consumed 367±12.4 gm/man/day or 57%; the RCW group had 661 gms/CHO/day available and consumed 410±15.4 gm/man/day or 62%; the RLW group had 400 gm/CHO/day available and consumed 345 gm/man/day or 86%. The higher intake of carbohydrate (approx. 50 gms) for the RCW group was not statistically significant. The RCW group did consume a higher carbohydrate, lower protein and fat diet (13.1% pro:

56.7% CHO; 30% fat) than either the IMRE or RLW groups. If caloric intake could be improved while still maintaining these macronutrient ratios, this ration would be similar to what the literature recommends for prolonged endurance activity; namely, a high carbohydrate diet which encourages frequent snacking.

The IMRE group did not meet the MRDA guidelines for magnesium. Low consumption rates of highly fortified items such as the peanut butter, cocoa beverage powder and some dessert items are possible causes. Folate intakes were only 59% of the MRDA of 400 mcg. It should be noted that although all ration items have been analyzed for folate, the microbiological assay technique available to determine the folate content of foods may be inaccurate and therefore unreliable at this time.

Complete nutrient data was not available for calculation of nutrient intakes in previous RCW ration tests (7). The present study is the first wherein complete RCW nutrient intakes could be calculated. The nutrient data base, however, is presently restricted to only one or two data points and may not accurately reflect the nutrient content of the RCW ration. It was found that the RCW ration did not meet the MRDA of 2.2 mg/day for riboflavin, 400 mcg for folacin, 18 mg for iron and 15 mg for zinc. Increased fortification of the flavored oatmeal and cocoa beverage powder is planned. Also, as with the IMRE ration, folacin values may be inaccurate due to the unreliablity of the microbiological assay technique. Low consumption of the orange beverage bar which contains approximately 30% of the riboflavin and approximately 50% of the calcium contributed to the lower intake of these nutrients as well.

Food Item Selection and Consumption

Food item consumption rates for the IMRE suggest that ration components were well received. Beverage powders were not used to the extent anticipated based upon temperate weather studies (1,9). If the consumption rate of the beverage powders could be improved under cold weather conditions soldiers could increase their energy and fluid intake.

Food item consumption rates for the RCW show that fruit soup and orange beverage bar were not consumed as much as the ice tea or chicken noodle soup. As has been suggested in other studies (5-7) decreasing or omitting certain food items and replacing them with more acceptable ones might increase RCW calorie and fluid intakes. Since the entree in each ration is extremely popular it could be separated into two parts by increasing the carbohydrate portion while not affecting the protein content of the ration. This would provide more variety to the noon meal and possibly increase the caloric intake.

The food consumption rates for the RLW ration indicate that the majority of items were well received, especially the entrees, beef jerky, and cereal bars. The exception to this was the bread crisps which were not as popular in this field test as in others (9).

The results of this study indicate that the palatability and fortification of the RCW needs to be improved to make it a more effective cold weather ration. The RLW, while not designed as a cold weather ration, could be used as such if necessity demands. The IMRE has utility as a cold weather ration, especially when repeated freeze-thaw cycles can be avoided and weight and bulk are not critical considerations.

CONCLUSIONS

For these highly motivated, well equipped Marines all three rations were adequate to sustain field operations for 11 days in this type of moderate altitude, cold weather environment. As has been seen in other field studies, soldiers consumed insufficient calories to maintain their body weight and the approximately 1500 kcal/day caloric deficit observed cautions against the use of these rations beyond 10-14 consecutive days under conditions of heavy physical activity. Factors in addition to ration palatability and acceptance probably contribute to inadequate energy intakes and body weight loss. These factors should be identified and, insofar as possible, corrected. Ration palatability and acceptance could be improved by relatively minor menu modification, possibly increasing energy intake.

RECOMMENDATIONS

1. Divide the RCW entree into two separately packaged portions (to facilitate having two entrees available for two meals) and increase carbohydrate component of each to increase caloric intake without increasing the protein content.
2. Increase the riboflavin, folacin, calcium, iron, and zinc content of the RCW ration by fortifying the oatmeal and cocoa beverage powder as planned. Also, replace one of the more unpopular and highly fortified beverage or snack foods with a dairy bar.
3. Replace unpopular RCW beverage items such as the fruit soups and orange beverage bar with a palatable high-carbohydrate supplement powder.
4. Improve the palatability of the RLW bread crisps items.

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TABLE 1

RATIONS

The macronutrient composition of the IMRE, RCW and RLW are:

	IMRE[1]	RCW[2]	RLW[3]
Protein, g	193	120	142
Carbohydrate, g	644	661	400
Fat, g	204	149	230
Energy, kcal	5192	4470	4219
Sodium, mg	7208	4547	6654
Total Mass, g	2880	1320	912
Volume, cubic in.	360	225	74

[1] Four IMRE meals per man per day were issued
[2] One RCW ration per man per day was issued
[3] Two RLW rations per man per day and one accessory packet every four days were issued

TABLE 2

DATA COLLECTION SCHEDULE

	PRE STUDY	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	DAY 8	DAY 9	DAY 10	DAY 11	POST STUDY
FOOD/WATER INTAKE		X	X	X	X	X	X	X	X	X	X	X	
FOOD WRAPPER COLLECTION											X		
RATION ACCEPTANCE		X	X	X	X	X	X	X	X	X	X	X	
HEIGHT	X												
WEIGHT	X						X						X
PACK WEIGHT		X							X				
% BODY FAT	X												X
VO_2 MAX	X												X
BLOOD CHEMISTRY	X												X
URINE SPECIFIC GRAVITY	X	X		X		X	X		X		X		X
FINAL QUESTIONNAIRE													X

TABLE 3

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

SUBJECTS PHYSICAL CHARACTERISTICS*

VARIABLE	IMRE	RCW	RLW	RANGE
Age, years	28.80±1.90	25.80±0.90	27.00±0.70	37.00 - 21.00
Height, cm	69.60±1.10	69.80±0.80	71.30±0.70	64.10 - 74.40
Weight, kg	80.40±2.10	81.50±3.10	81.60±2.10	66.70 - 105.00
Body Fat, %	20.30±1.00	20.60±1.40	19.00±1.00	28.10 - 13.90
VO_2 Max, l/min	3.38±0.10	3.30±0.09	3.59±0.16	2.94 - 4.32
VO_2 Max, ml/kg/min	42.50±1.34	41.04±1.90	43.98±1.65	32.50 - 52.40

* Values, Mean±SEM

TABLE 4

DISTRIBUTION OF WATER INTAKES (ml)

	IMRE	RCW	RLW
Water From Food	610 ± 19.2	46 ± 7.8	34 ± 1.3
Water Added To Ration	2010 ± 156.3	2839 ± 189.1	1843 ± 129.7
Plain Water Intake	2652 ± 190.8	2393 ± 173.1	2810 ± 150.7
Total Water Intake	5273 ± 301.9	5277 ± 255.0	4687 ± 170.0

TABLE 5

NUMBER OF SUBJECTS IN EACH RATION GROUP WHO HAD URINE SPECIFIC GRAVITIES ABOVE 1.030*

		Frequency per Day							
	N	PRE	DAY 1	DAY 4	DAY 6	DAY 7	DAY 9	DAY 11	POST
IMRE	8	1	1	0	0	0	0	1	0
RCW	*10	0	0	0	2	1	1	1	4
RLW	10	1	0	2	3	1	2	1	3

	Frequency per Total Obervations		
	IMRE	RCW	RLW
Urine Specific Gravity > 1.030	3/64 (5%)	9/77 (11%)	13/80 (16%)

* One test subject had to leave the study on day 8

TABLE 6

Blood Chemistries	IMRE	RCW	RLW
Pre Glucose (mg/dl)	95.4 ± 2.2	95.3 ± 1.9	92.4 ± 1.5
Post Glucose (mg/dl)	90.7 ± 1.4	88.1 ± 1.8	98.4 ± 2.8
Pre BUN (mg/dl)	13.9 ± 1.1	14.0 ± 1.1	13.5 ± 1.3
Post BUN (mg/dl)	14.6 ± 1.0	17.7 ± 1.2	18.9 ± 1.4
Pre Triglyceride	58.3 ± 10.6	77.4 ± 10.8	60.5 ± 7.5
Post Triglyceride	38.3 ± 6.1	51.2 ± 11.6	34.3 ± 2.8
Pre Cholesterol (mg/dl)	174.5 ± 7.3	206.4 ± 10.0	169.0 ± 12.0
Post Cholesterol (mg/dl)	157.9 ± 5.7	171.0 ± 10.2	154.3 ± 10.2

TABLE 7

Ten Day Mean Nutrient Intakes of the IMRE, RCW and RLW Rations Compared to the MRDA

NUTRIENT	MRDA	IMRE GROUP	%MRDA	RCW GROUP	%MRDA	RLW GROUP	%MRDA
Energy, kcal*	4500.0	3216.95 ± 100.72	71.5	2891.62 ± 103.20	64.3	3205.42 ± 136.68	71.2
Protein, g	100.0	132.99 ± 3.77	132.9	94.69 ± 2.71	94.7	108.74 ± 3.68	108.7
Carbohydrate, g	440.0	368.76 ± 12.46	83.8	410.20 ± 15.37	93.2	344.57 ± 14.67	78.3
Fat, g	160.0	135.65 ± 4.63	84.9	96.62 ± 4.24	60.4	154.54 ± 8.09	96.6
vitamin A, mcg	1000.0	2201.03 ± 102.17	220.1	1507.44 ± 102.17	150.7	1373.42 ± 83.00	137.3
Ascorbic Acid, mg	60.0	224.31 ± 8.56	373.9	99.65 ± 8.56	166.1	185.87 ± 14.50	309.9
Thiamin (B_1), mg	1.8	7.71 ± 0.30	428.3	3.52 ± 0.20	195.6	3.30 ± 0.21	183.3
Riboflavin (B_2), mg	2.2	2.96 ± 0.10	134.6	1.23 ± 0.05	55.9	4.26 ± 0.27	193.6
Niacin, mg NE	24.0	34.60 ± 1.19	144.2	26.52 ± 1.05	110.5	53.96 ± 2.59	223.8
Vitamin B_6, mg	2.2	5.42 ± 0.22	246.4	2.35 ± 0.16	106.8	5.68 ± 0.42	258.2
Folacin, mcg	400.0	236.53 ± 8.83	59.1	142.12 ± 5.77	35.5	659.64 ± 48.77	164.9
Calcium, mg	800.0	1170.28 ± 38.79	146.3	653.65 ± 37.90	81.7	1484.97 ± 90.68	185.6
Phosphorus, mg	800.0	2014.05 ± 69.48	251.8	1690.16 ± 51.74	211.3	1903.45 ± 75.84	237.9
Magnesium, mg	400.0	316.93 ± 12.09	79.2	382.11 ± 13.91	95.5	615.66 ± 42.62	153.9
Iron, mg	18.0	17.32 ± 0.53	96.2	11.37 ± 0.41	63.2	29.8 ± 1.81	165.6
Zinc, mg	15.0	not available	---	9.13 ± 0.41	60.9	31.5 ± 1.66	210.0
Sodium, mg*	-------	5804.52 ± 183.71	------	3530.65 ± 107.00	------	4533.2 ± 159.25	------
Potassium mg*	-------	3148.50 ± 114.68	------	3321.29 ± 104.28	------	5370.0 ± 285.73	------

*There is no MRDA for sodium or potassium

*Energy allowances of 4500 calories for men are required to support adequately clothed troops maneuvering for prolonged periods with heavy gear on foot, snowshoes, and skis over snow- or ice-convered terrain.

FIGURE

FIGURE LEGENDS

1. Mean body weight in kilograms pre, day 6 and post experiment for the IMRE, RCW and RLW groups. There were no significant differences in body weight loss between ration groups at any time period, although the pre vs. post body weight were significantly different ($P<0.05$) within each ration group.

2. Mean body weight loss on day 6 and post experiment for the IMRE, RCW and RLW groups. There were no significant differences in body weight loss between ration groups but all pre to post weight losses within ration groups were significantly different ($P<0.05$).

3. Mean percent body fat loss pre and post experiment for the IMRE, RCW and RLW groups. Significant pre vs post body fat loss within ration group is denoted by a star above the standard mean error bar. The IMRE and RLW groups lost significantly ($P<0.05$) more body fat than did the RCW group.

4. Mean pack weight in kilograms for weeks 1 and 2 for the IMRE, RCW and RLW groups. There were no significant differences in pack weights between ration groups. Note the IMRE group was resupplied mid week due to the heavy, bulky nature of their ration, whereas the RCW and RLW groups were not.

5. Mean semi-nude weight, dressed weight with weapon and weight with weapon plus pack for the IMRE, RCW and RLW groups. There were no significant differences in these weights between ration groups.

6. Mean 10 day water consumption in food, water added to food and water drunk for the IMRE, RCW and RLW group. The IMRE ration contained significantly ($P<0.05$) more water than either the RCW or RLW rations. This is denoted by a star above the standard mean error bar.

7. Mean 10 day total water consumption for the IMRE, RCW and RLW groups. There were no significant differences between ration groups.

8. Mean total water intakes for days 2-11 for the IMRE, RCW and RLW groups. Statistical analysis was not done on these values.

9. Mean total fluid intake for days 2-11 for the IMRE, RCW and RLW groups. Mean urine specific gravity for days 1,2,4,6,7,9,11,13 for the IMRE, RCW and RLW groups. Significance between ration groups is denoted by a star. The IMRE group had significantly lower urine specific gravity on day 13 than did the RCW and RLW groups.

10. Mean daily energy consumption for the IMRE, RCW and RLW groups. The solid line represents the MRDA of 4500 kcals for soldiers working in a cold environment. Statistical analysis was not done on day means. Mean energy consumption and standard error are also presented for each ration group.

11. Mean daily protein consumption for the IMRE, RCW and RLW groups. The solid line represents the MRDA of 100 gms/protein/day for soldiers. Statistical analysis was not done on day means. Mean protein consumption and standard error are also presented for each ration group.

12. Mean daily fat consumption for the IMRE, RCW and RLW groups. The solid black line represents the upper limit of fat consumption which is recommended. Statistical analysis was not done on day means. Mean fat consumption and standard error are also presented for each ration group.

13. Mean daily carbohydrate consumption for the IMRE, RCW and RLW groups. The solid black line represent the NSOR of 400 grams/day. Statistical analysis was not done on day means. Mean carbohydrate consumption and standard error are also presented for each ration group.

14. Mean 10 day consumption values for energy, protein, carbohydrate and fat. The solid black lines for energy (4500 kcals/man/day) and protein (100 gms/man/day) represent the MRDA; for carbohydrate (440 gms/man/day) the NSOR; and for fat the maximum (160 g/man/day). The RCW group consumed significantly ($P<0.05$) less protein and fat than either the IMRE or RLW groups. This is denoted by a star above the standard error bar. The IMRE group consumped significantly ($P<0.05$) less fat and more protein than the RLW group. This is denoted by a triangle above the standard error bar.

15. Mean 10 day consumption values for sodium for the IMRE, RCW and RLW groups. The solid black line represents the safe and adequate level of sodium recommended by the MRDA which is 5500 mg/man/day or 1700 mg/1000 kcal of diet. The RCW group consumed significantly ($P<0.05$) less sodium than either the IMRE or RLW group. This is denoted by a star above the standard error bar. The RLW group consumed significantly ($P<0.05$) less sodium than the IMRE group. This is denoted by a triangle above the standard error bar.

16. Mean 10 day consumption values for thiamin, riboflavin, niacin, and vitamin B_6. The solid black line represents the MRDA for thiamin (1.6 mg/day/man), riboflavin (1.9 mg/man/day), niacin (21 NE/man/day), and vitamin B_6 (2.2 mg/man/day). The RCW did not meet the MRDA for riboflavin.

17. Mean 10 day consumption values for ascorbic acid, vitamin A, sodium, and potassium. The solid black line represents the MRDA for ascorbic acid (60 mg/man/day), vitamin A (1000 RE/man/day), and sodium (5500 mg/man/day or 1700 mg/1000 kcals/day). There is no MRDA for postassium. The IMRE group was slightly higher than the MRDA for sodium.

18. Mean 10 day consumption values for iron, magnesium, calcium, and phosphorus. The solid black line represents the MRDA for iron (10-18 mg/man/day), magnesium (350-400 mg/man/day), calcium (800-1200 mg/man/day), and phosphorus (800-1200 mg/man/day). The IMRE group did not meet the MRDA for magnesium. The RCW group did not meet the MRDA for calcium.

19-21. Mean values for percentage of IMRE food items that were eaten. % eaten represents the percent of 10 days rations (40 meals). All IMRE issues, to our knowledge, were taken out into the field.

22-23. Mean values for percentage of RCW food items that were eaten. % eaten represents the percent of 10 days rations (10 rations). All RCW issues were taken out into the field.

24-26 Mean values for percentage of RLW food items that were eaten. % eaten represents the percent of 10 days rations (20 rations). All RLW issues were taken out into the field.

FIGURE 1

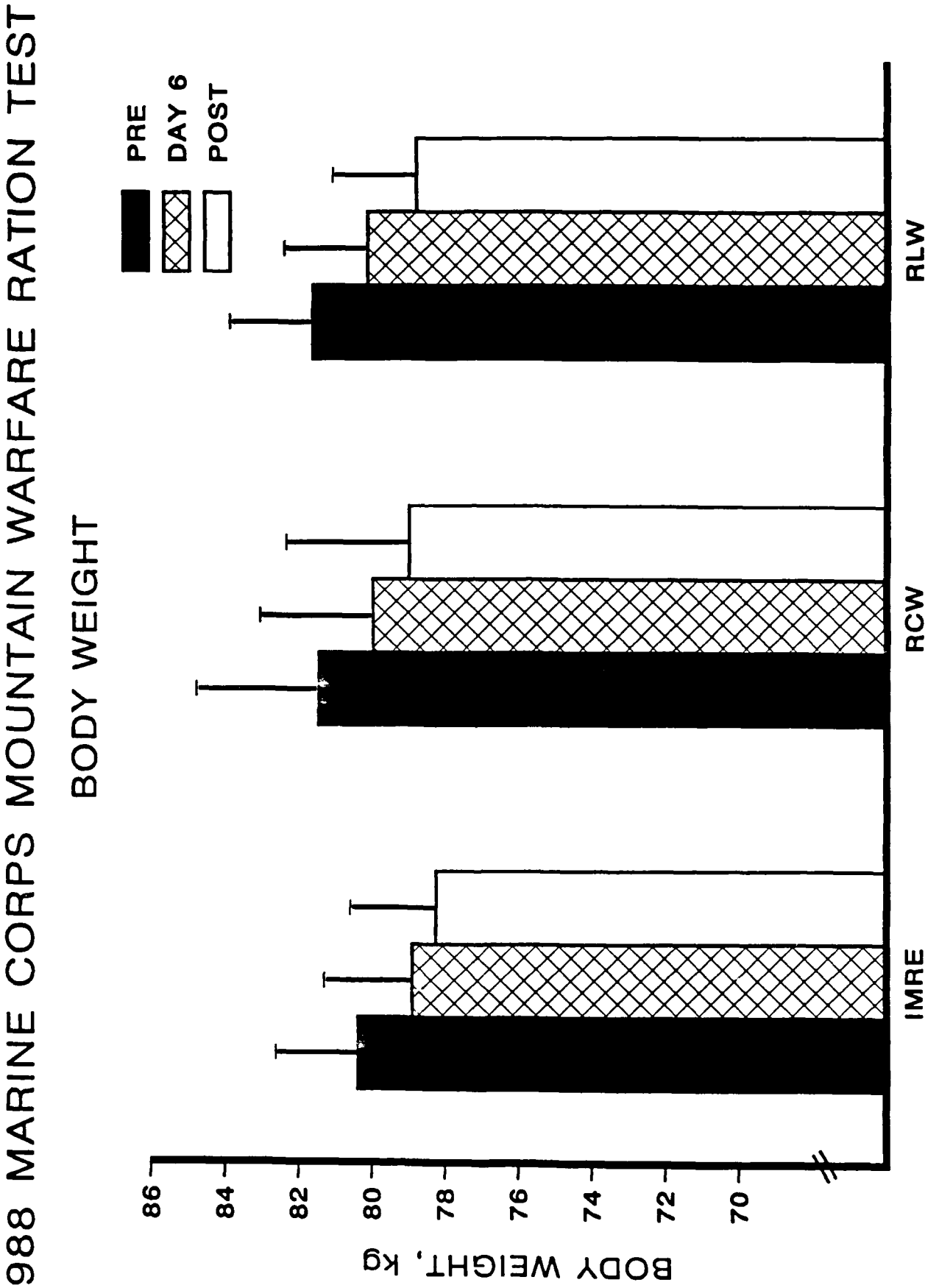
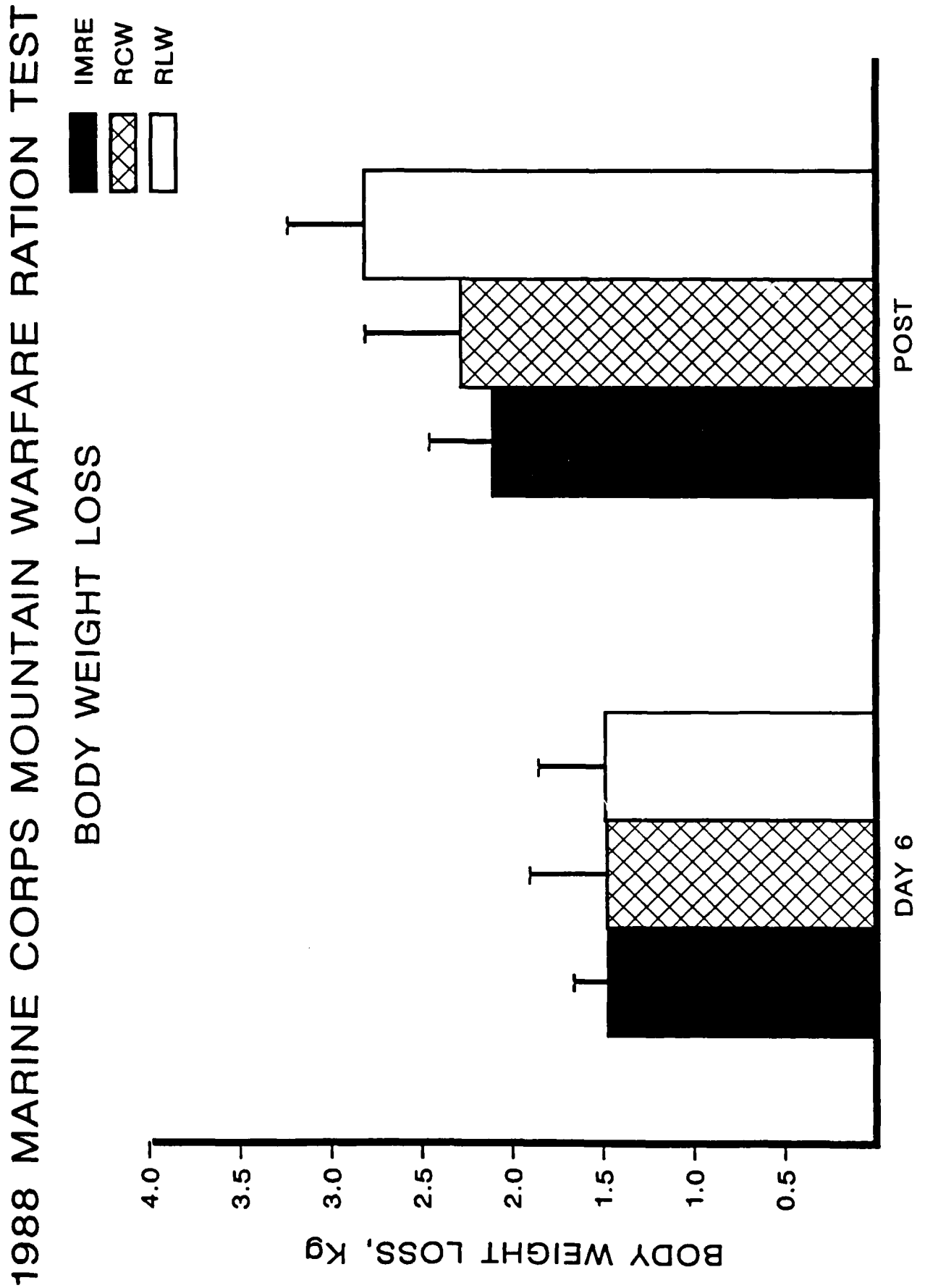
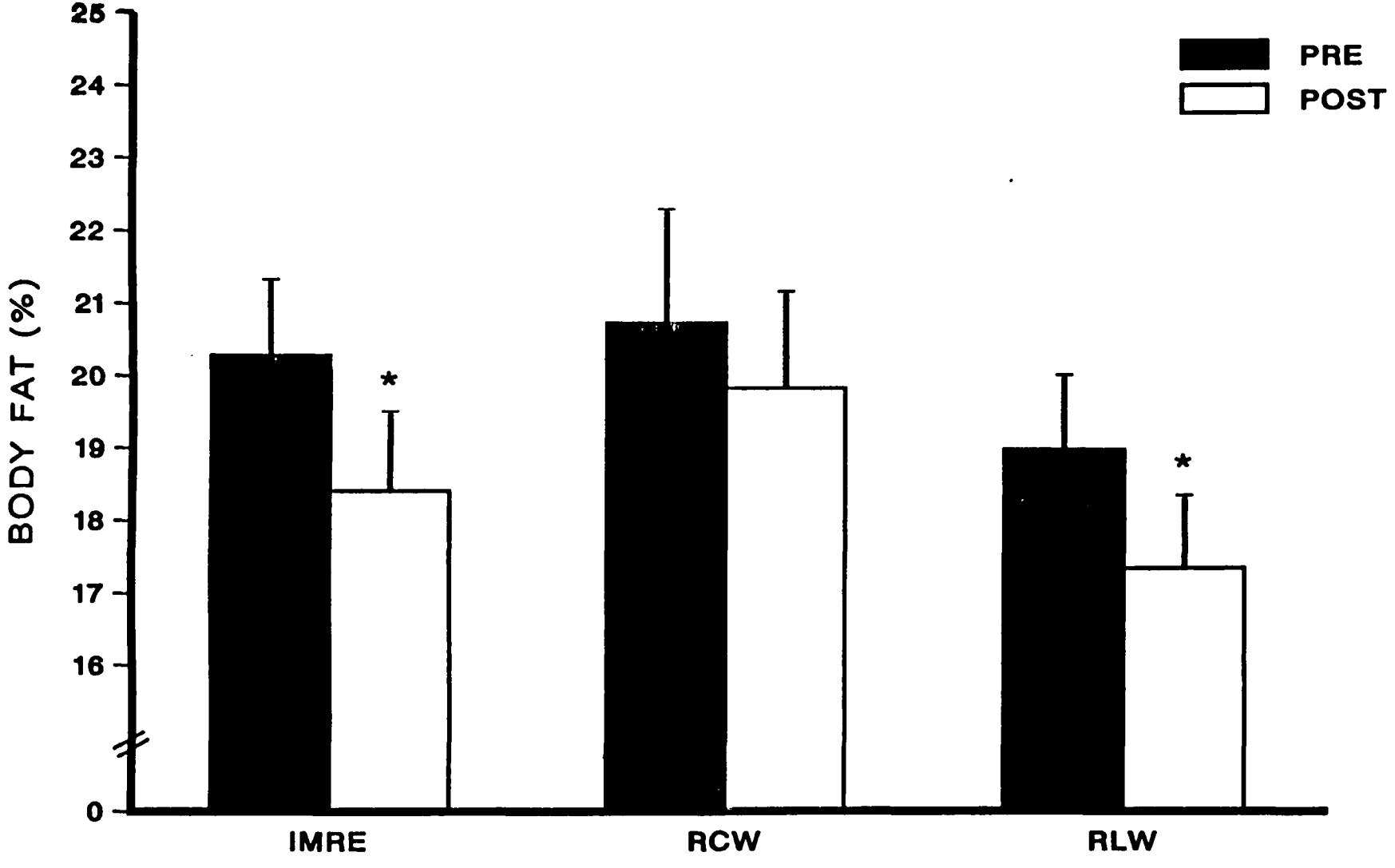

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST
BODY WEIGHT
PRE
DAY 6
POST
BODY WEIGHT, kg
86
84
82
80
78
76
74
72
70
IMRE
RCW
RLW

FIGURE 2


1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST
BODY WEIGHT LOSS
IMRE
RCW
RLW
BODY WEIGHT LOSS, Kg
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
DAY 6
POST

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

BODY FAT, PERCENT



* Significantly different, P < 0.05 Pre vs Post within ration groups

FIGURE 3

FIGURE 4

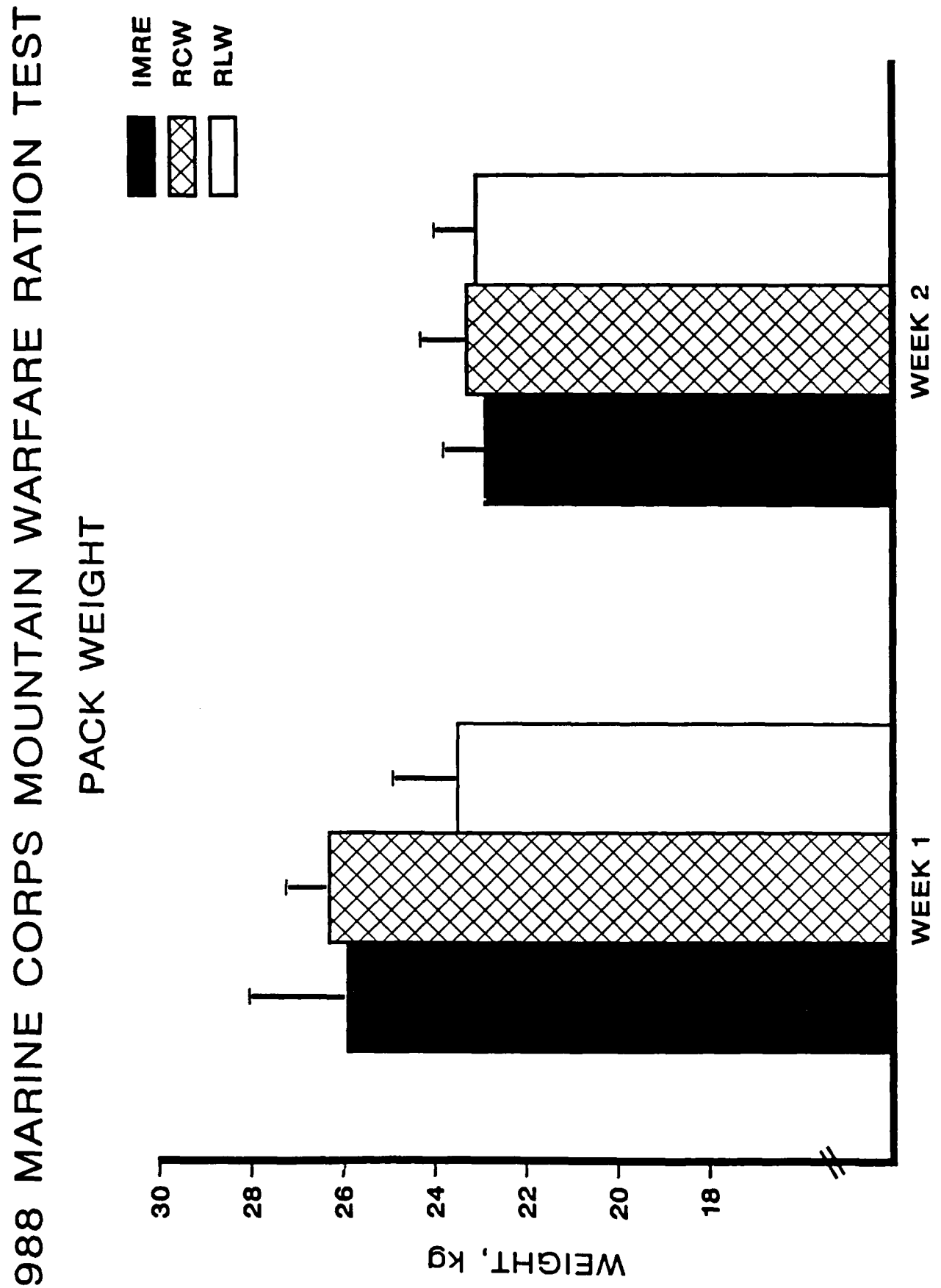

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST
PACK WEIGHT
IMRE
RCW
RLW
WEIGHT, kg
30
28
26
24
22
20
18
WEEK 1
WEEK 2

FIGURE 5

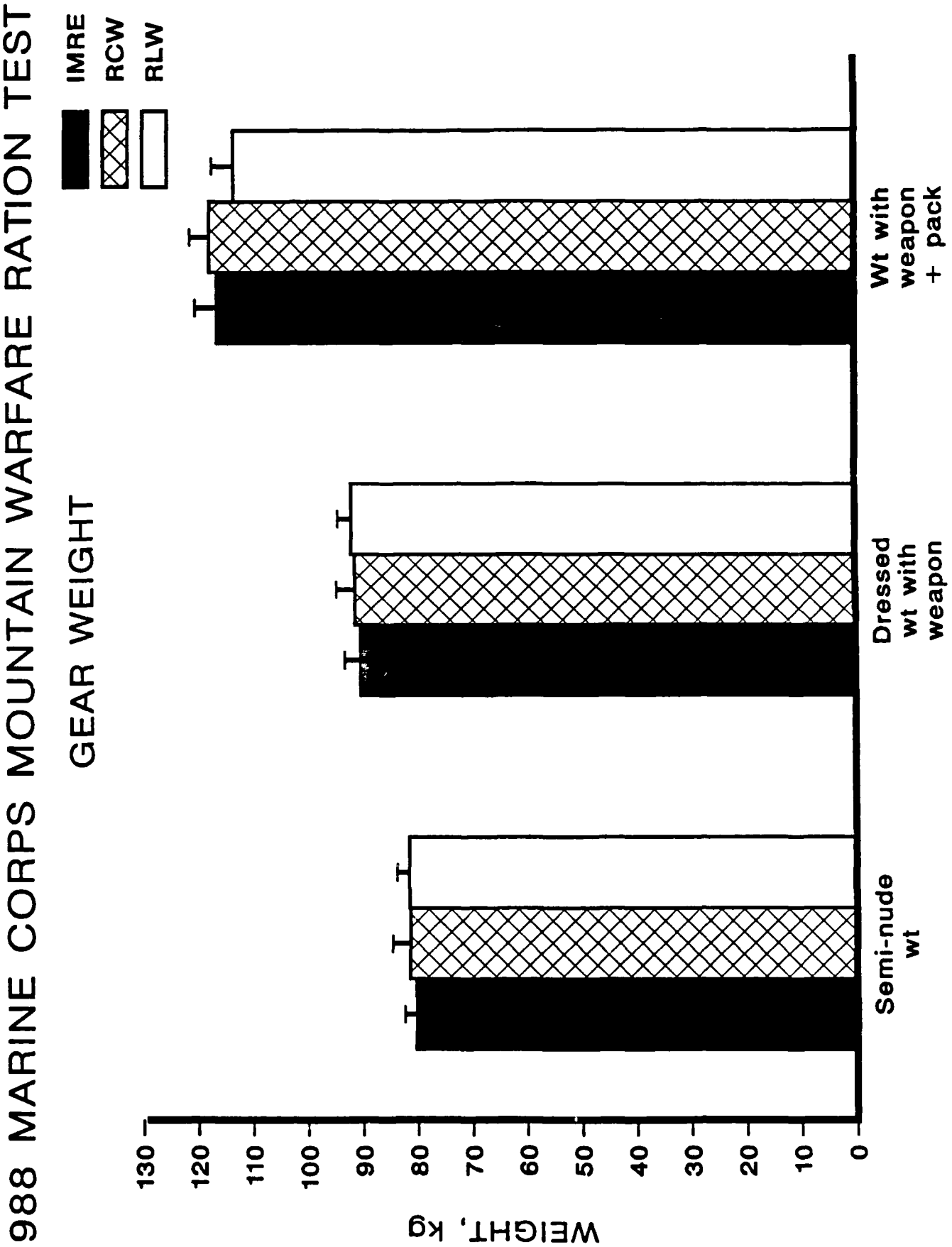

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST
GEAR WEIGHT
IMRE
RCW
RLW
WEIGHT, kg
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Semi-nude wt
Dressed wt with weapon
Wt with weapon + pack

FIGURE 6

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

WATER CONSUMPTION

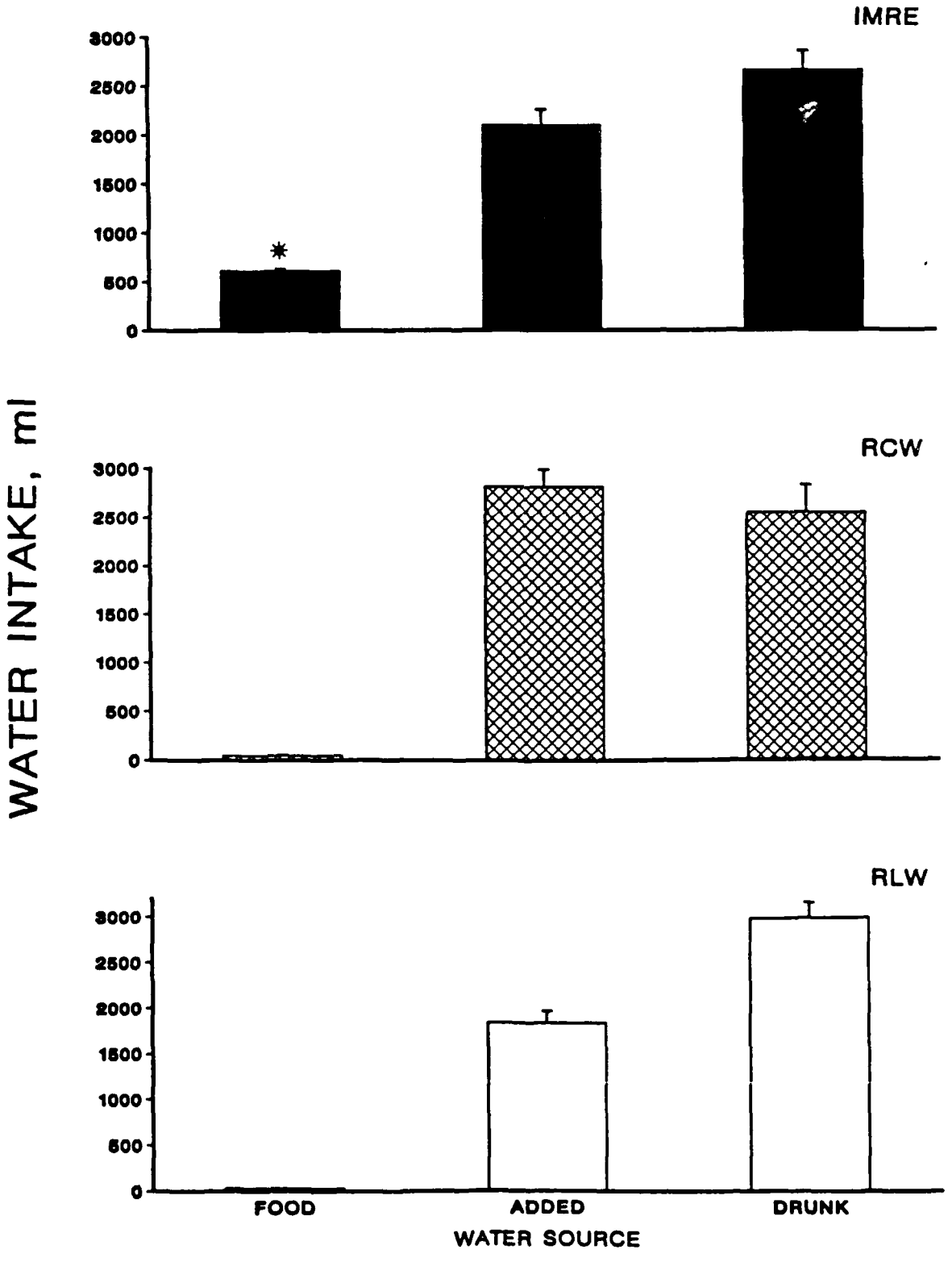


FIGURE 7

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

MEAN 10 DAY TOTAL FLUID CONSUMPTION

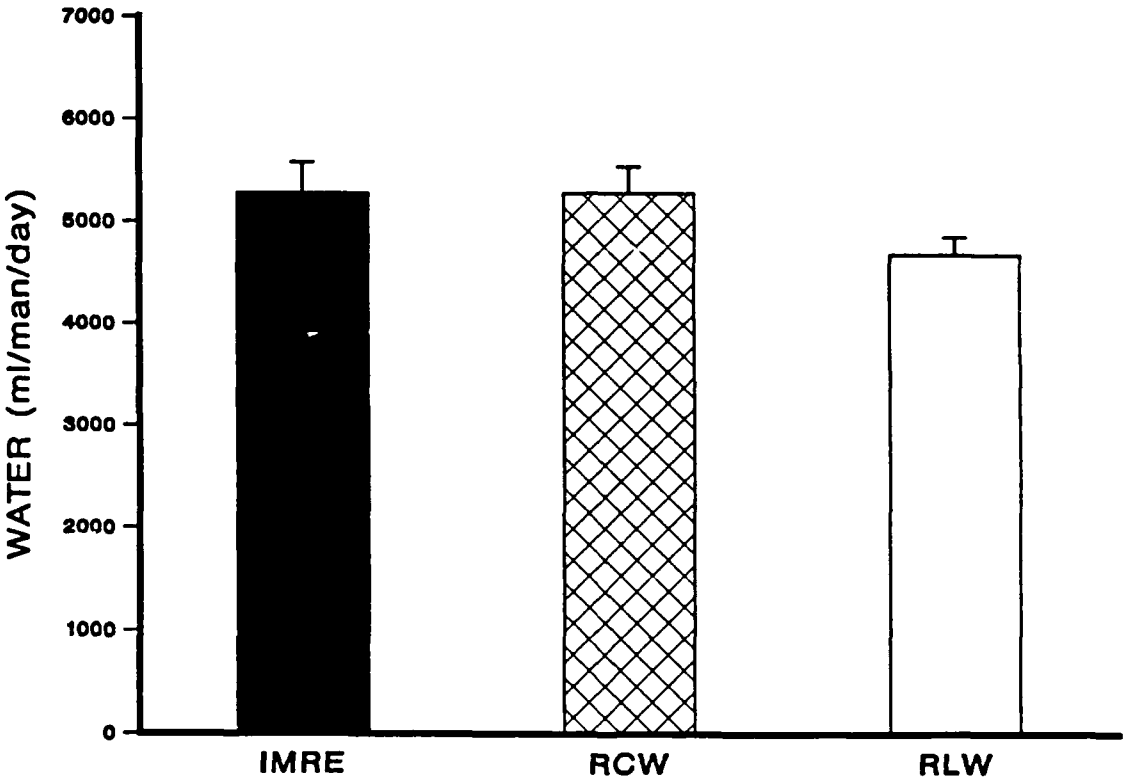


FIGURE 8

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

TOTAL DAILY FLUID INTAKES

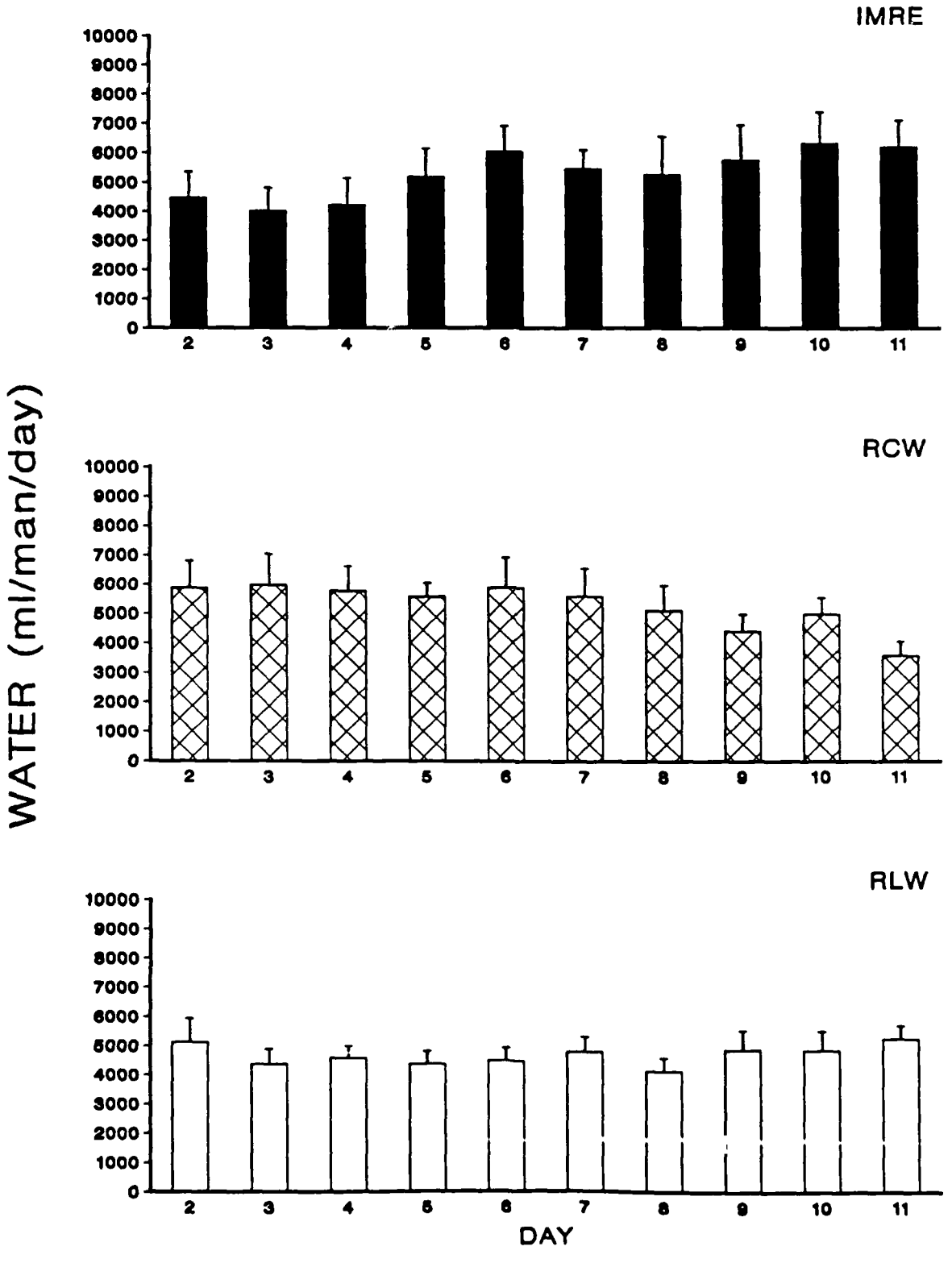
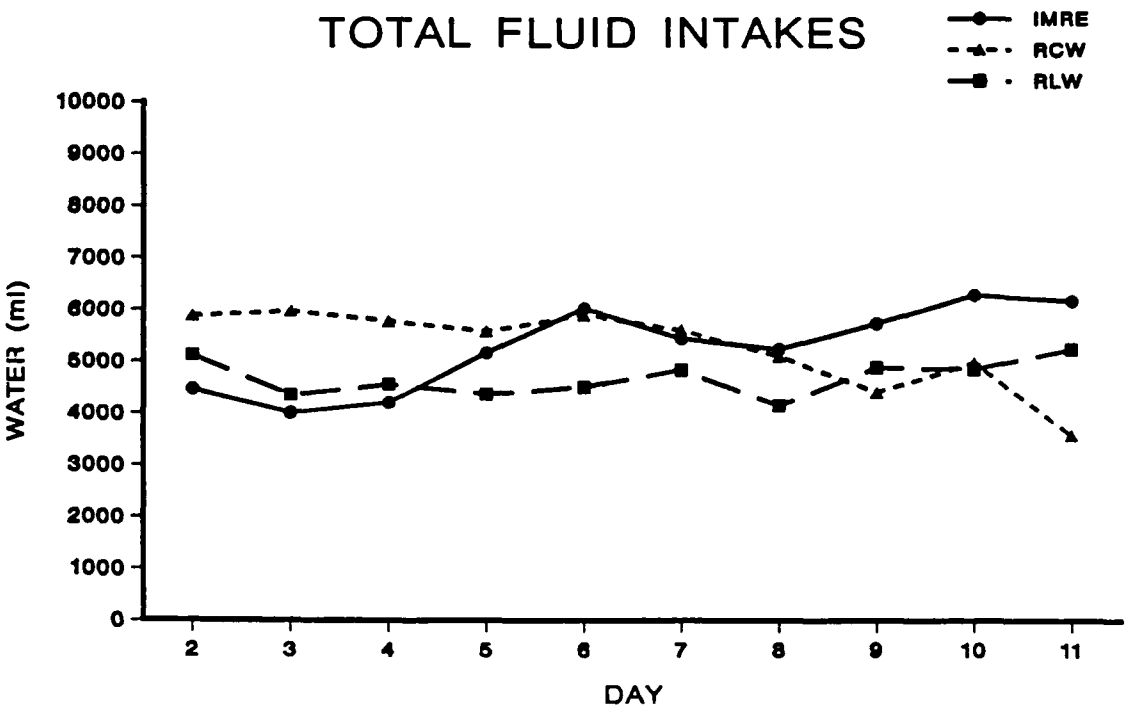


FIGURE 9

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST



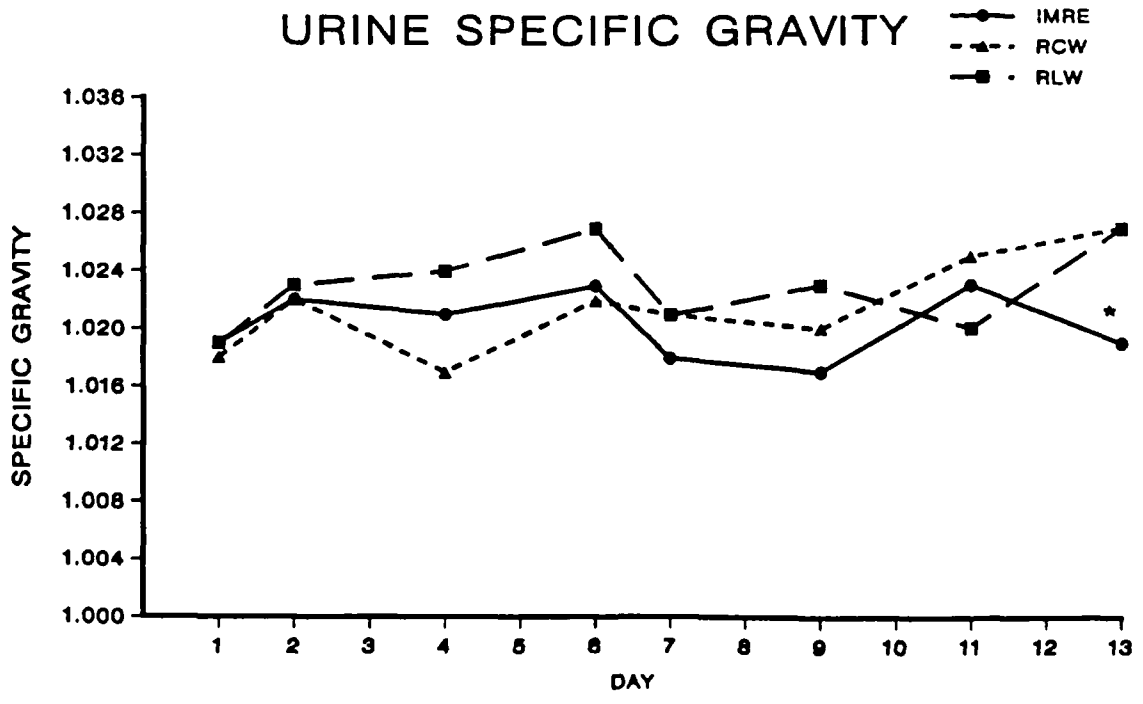


FIGURE 10

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

DAILY ENERGY CONSUMPTION

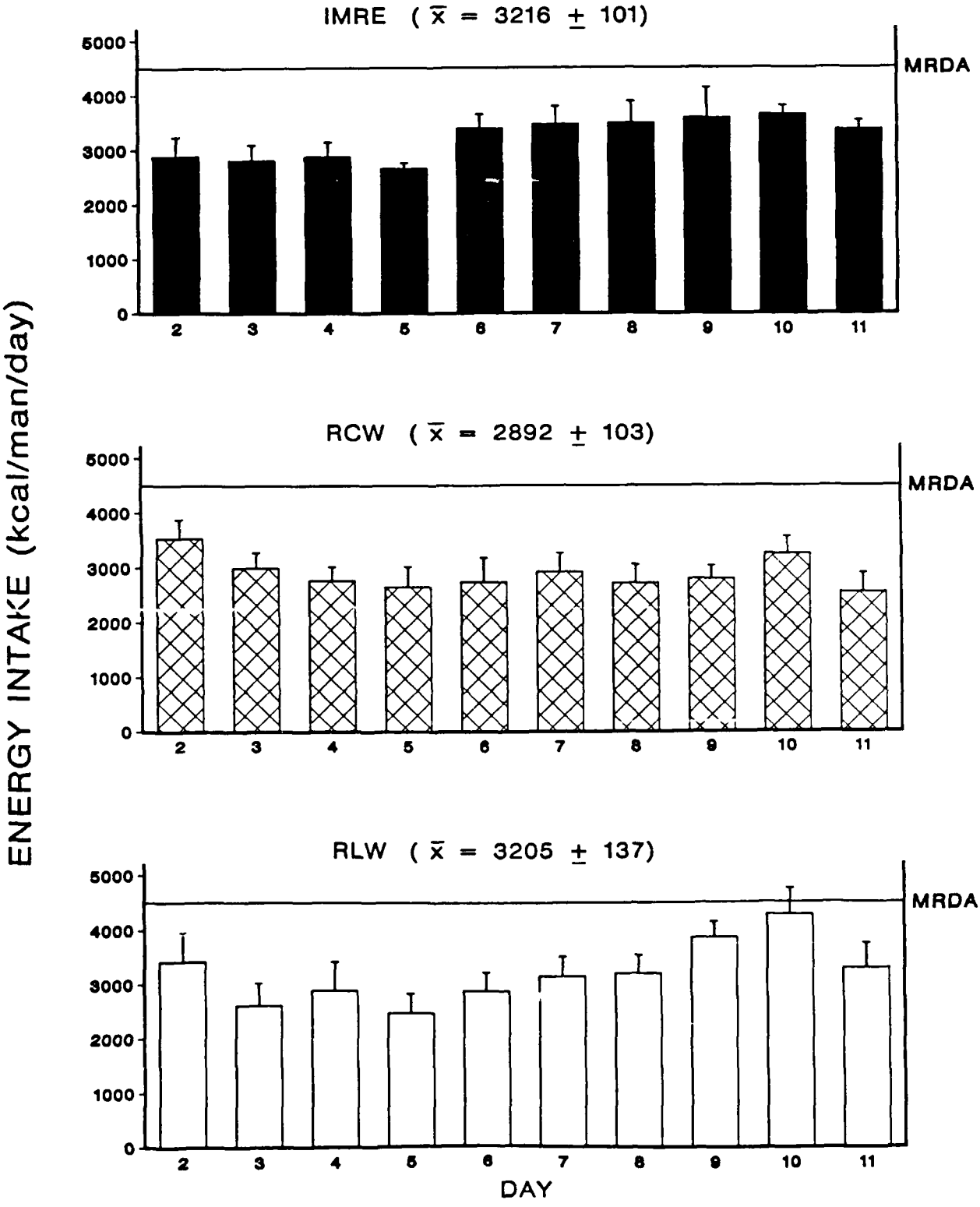


FIGURE 11

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

DAILY PROTEIN CONSUMPTION

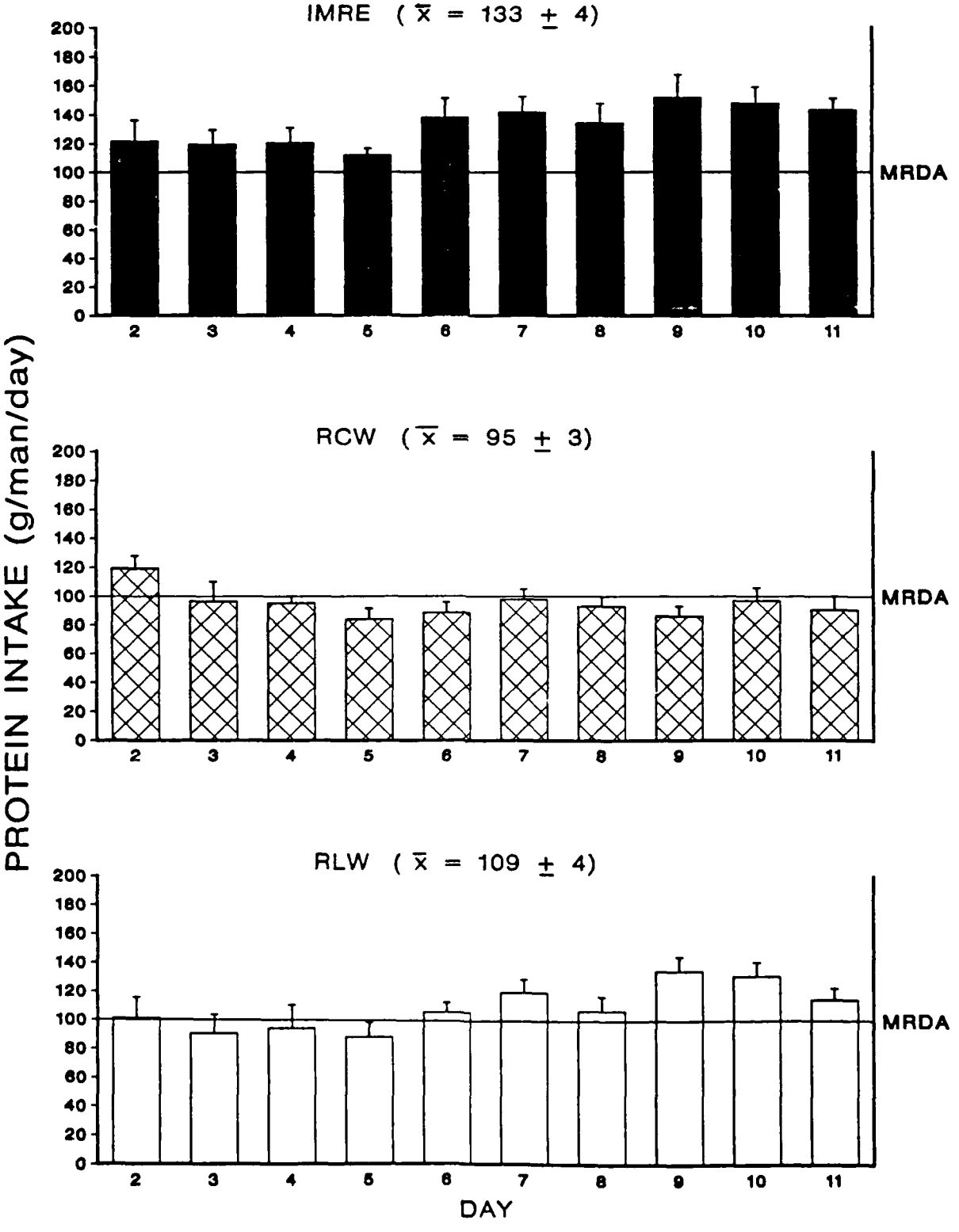


FIGURE 12

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

DAILY FAT CONSUMPTION

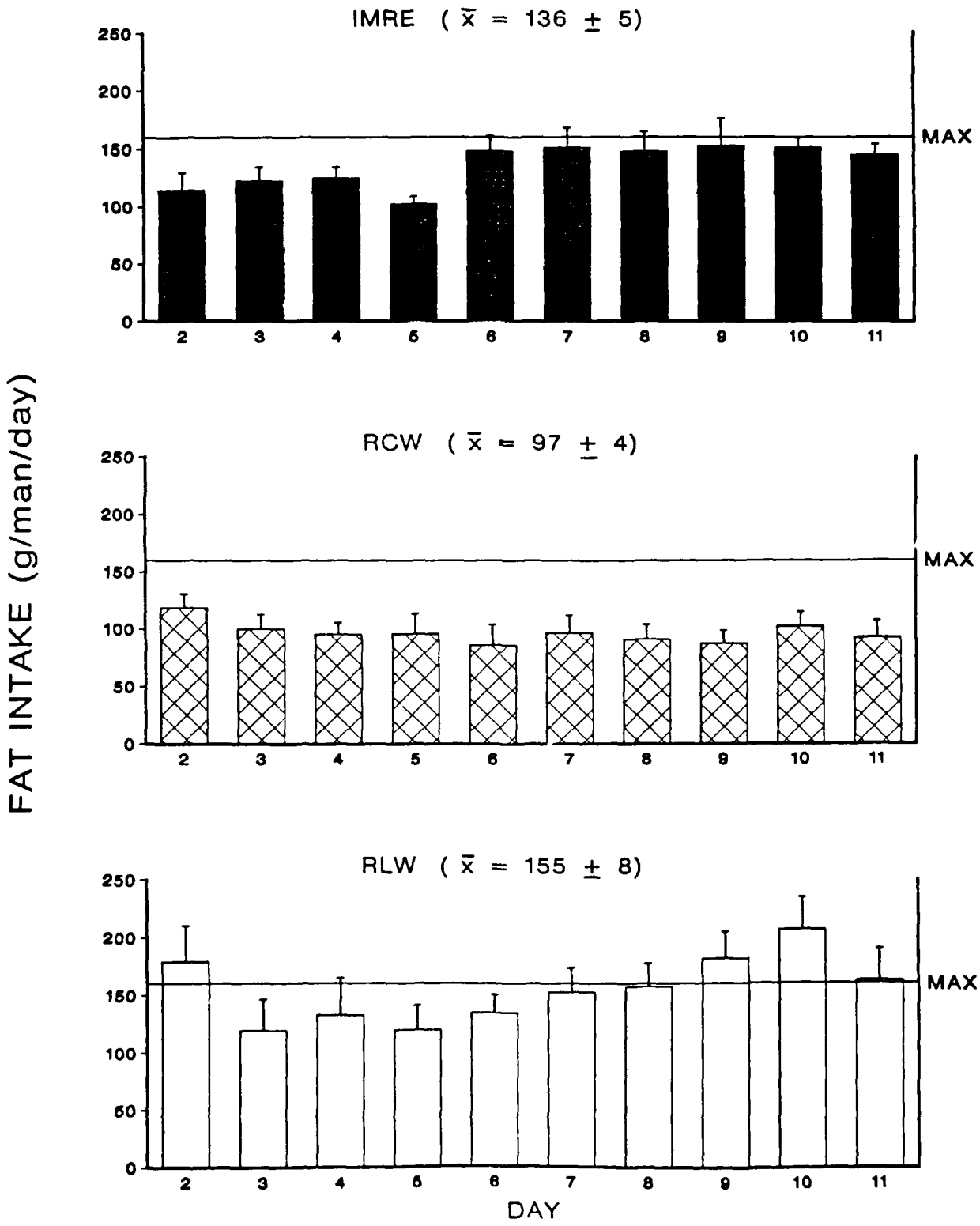


FIGURE 13

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

DAILY CARBOHYDRATE CONSUMPTION

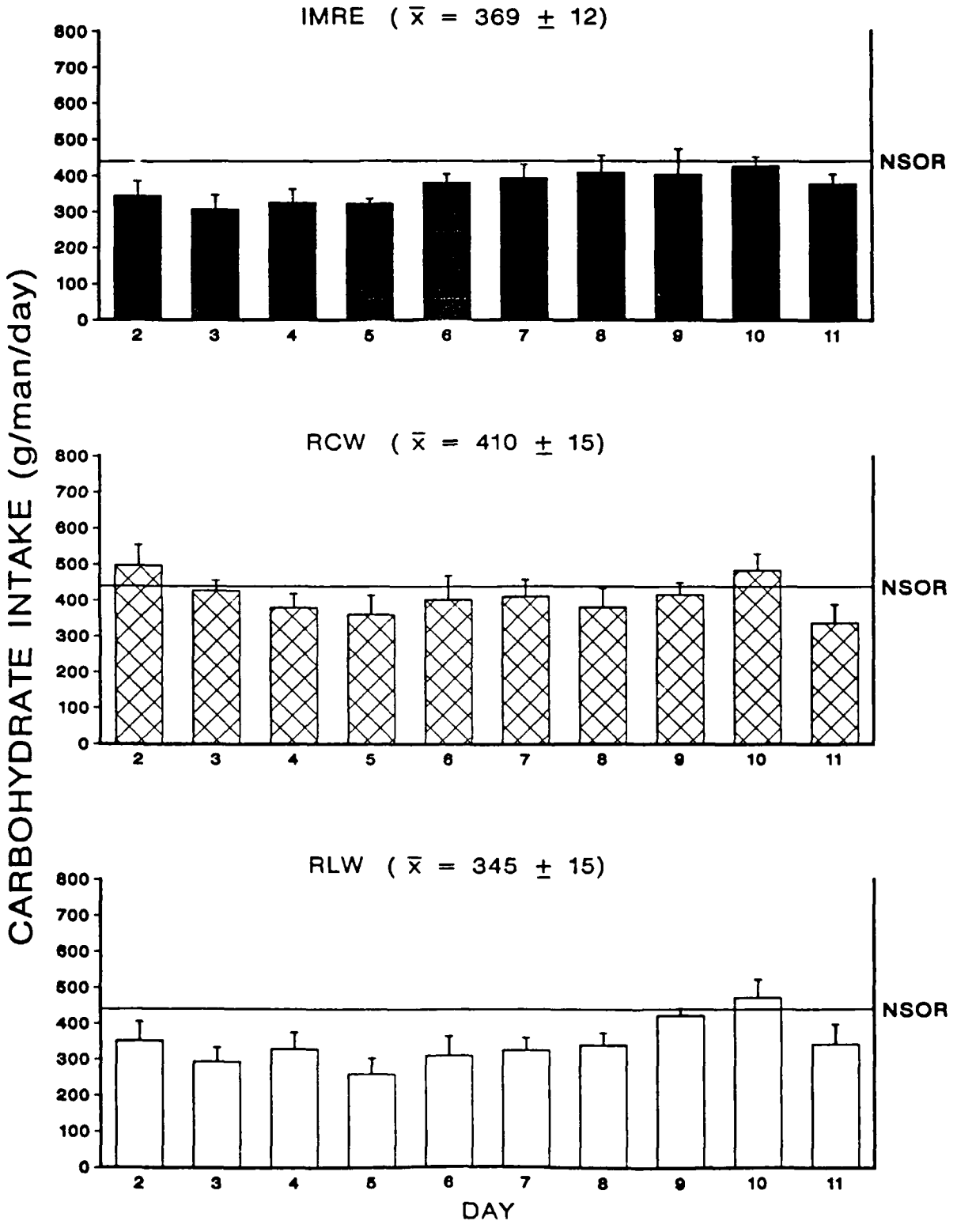


FIGURE 14

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

MEAN 10 DAY NUTRIENT INTAKES

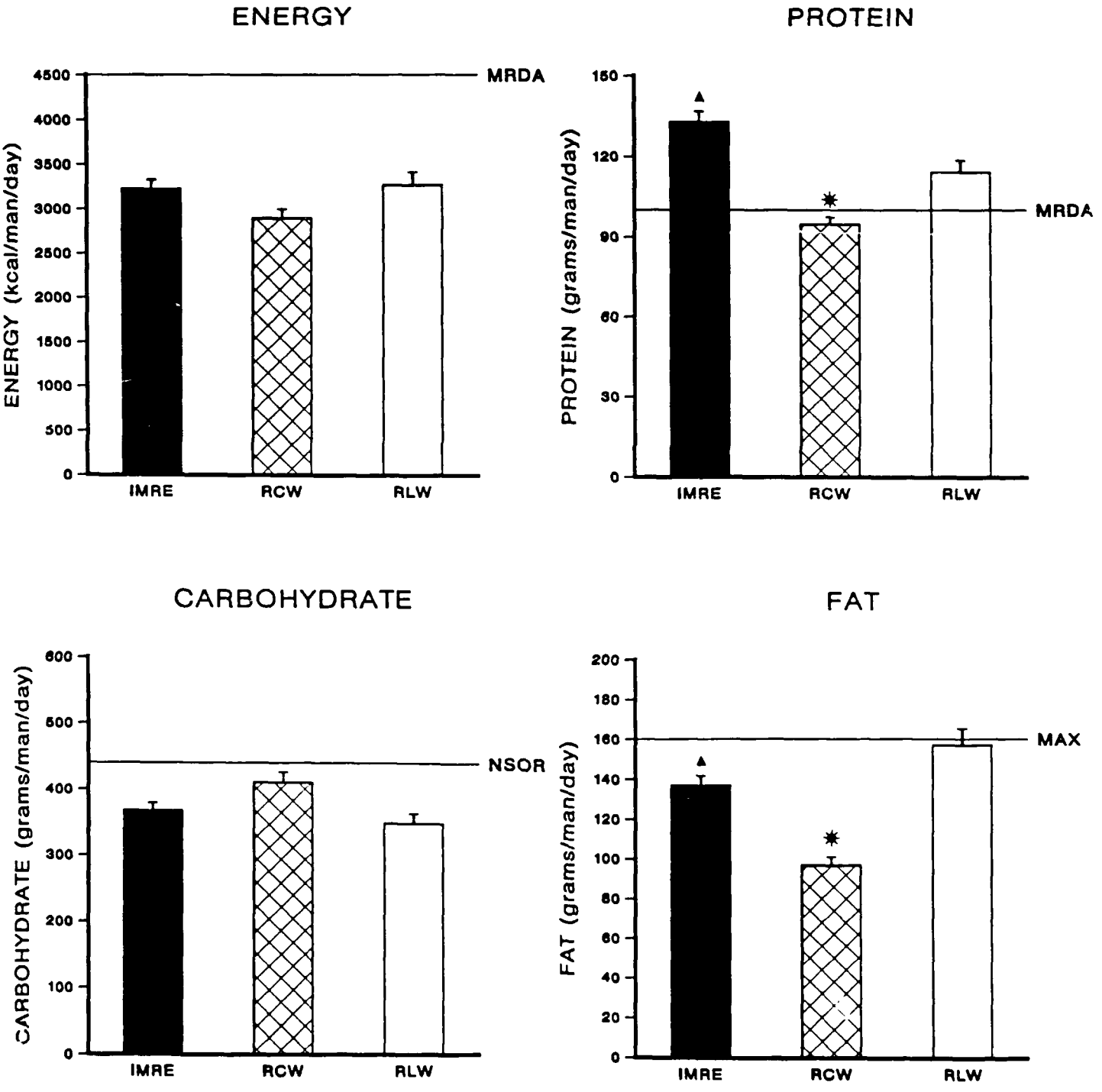
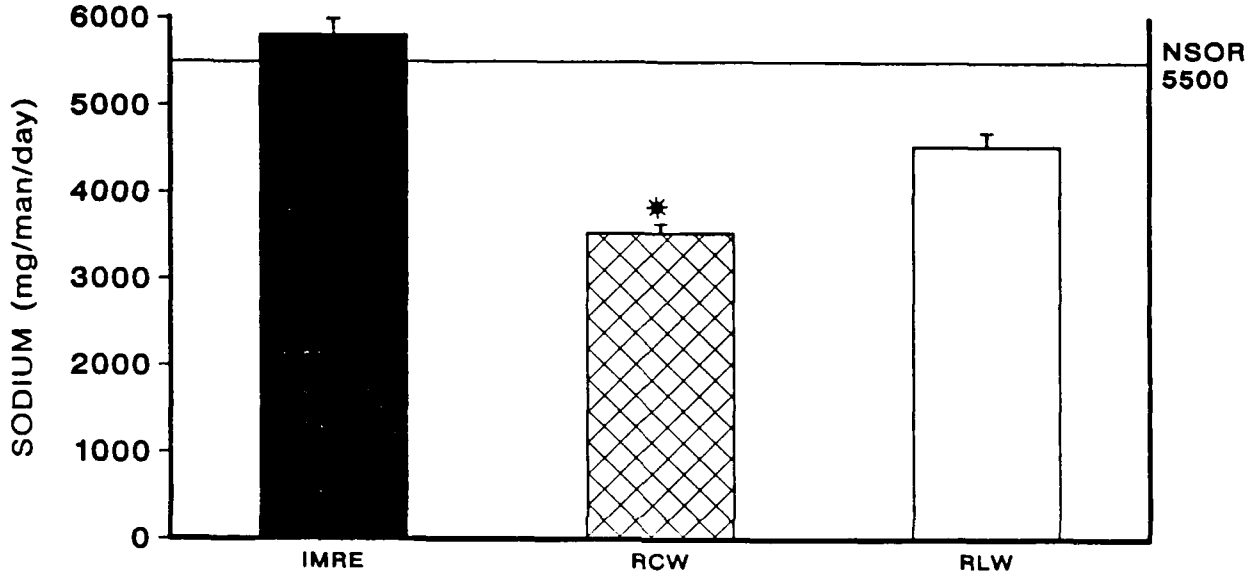


FIGURE 15

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

SODIUM CONSUMPTION



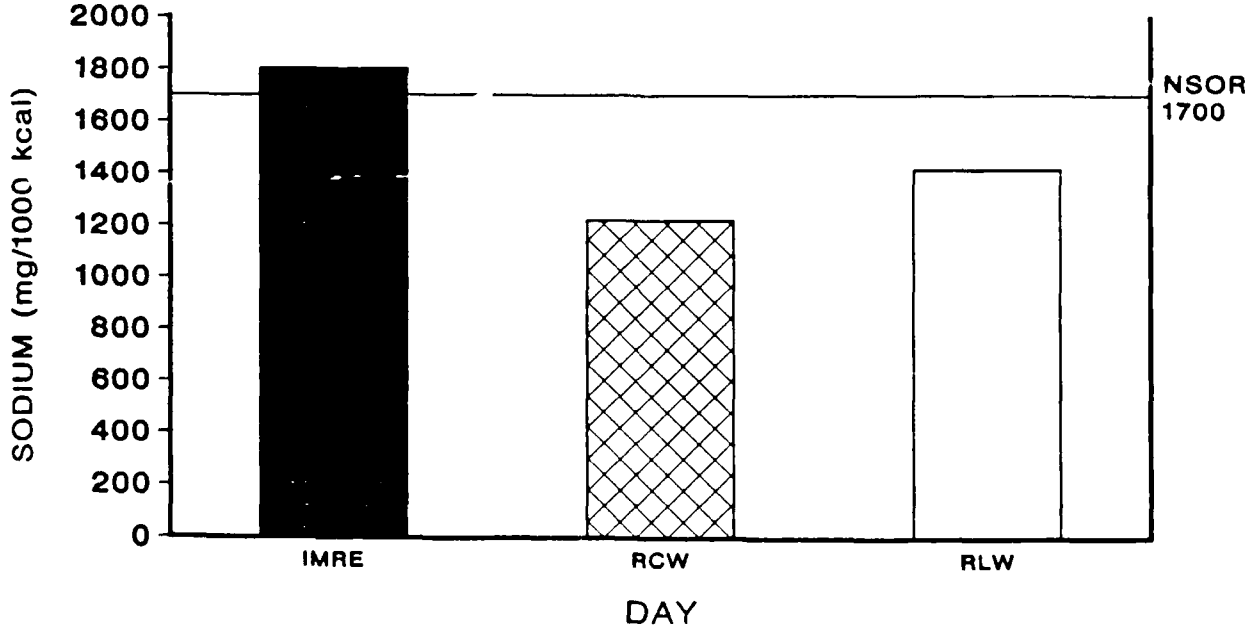


FIGURE 16

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

MEAN 10 DAY NUTRIENT INTAKES

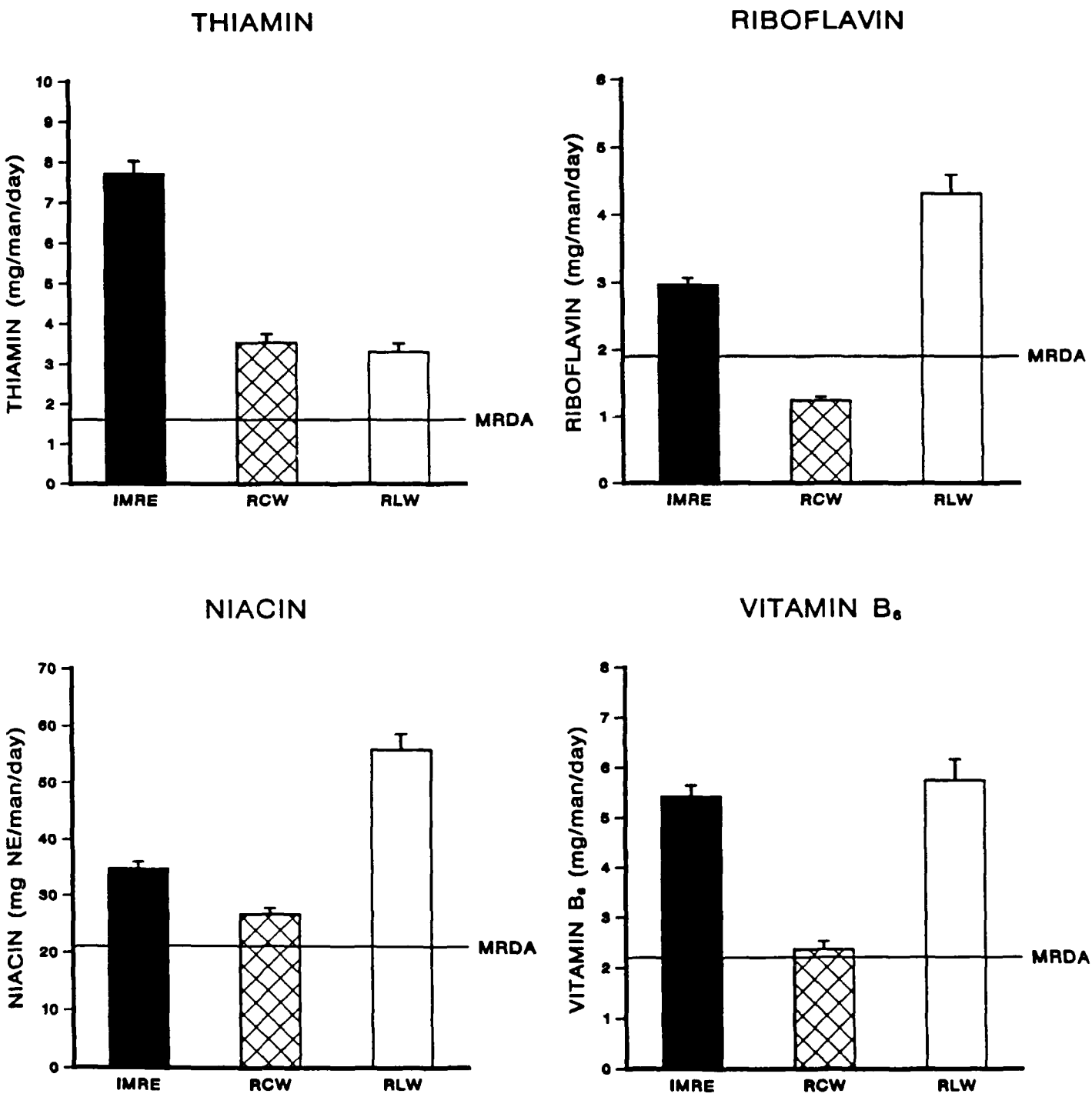


FIGURE 17

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

MEAN 10 DAY NUTRIENT INTAKES

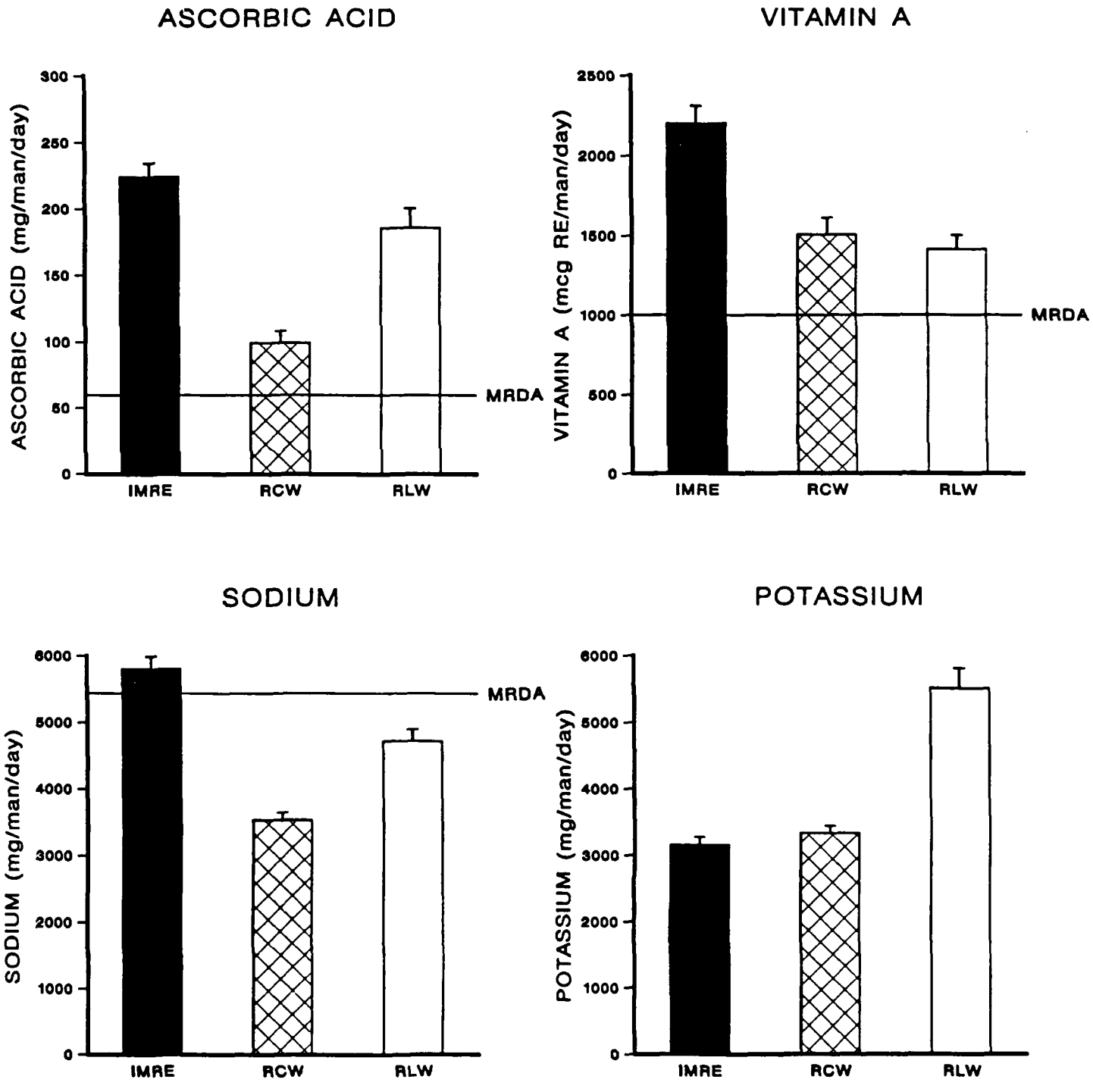


FIGURE 18

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

MEAN 10 DAY NUTRIENT INTAKES

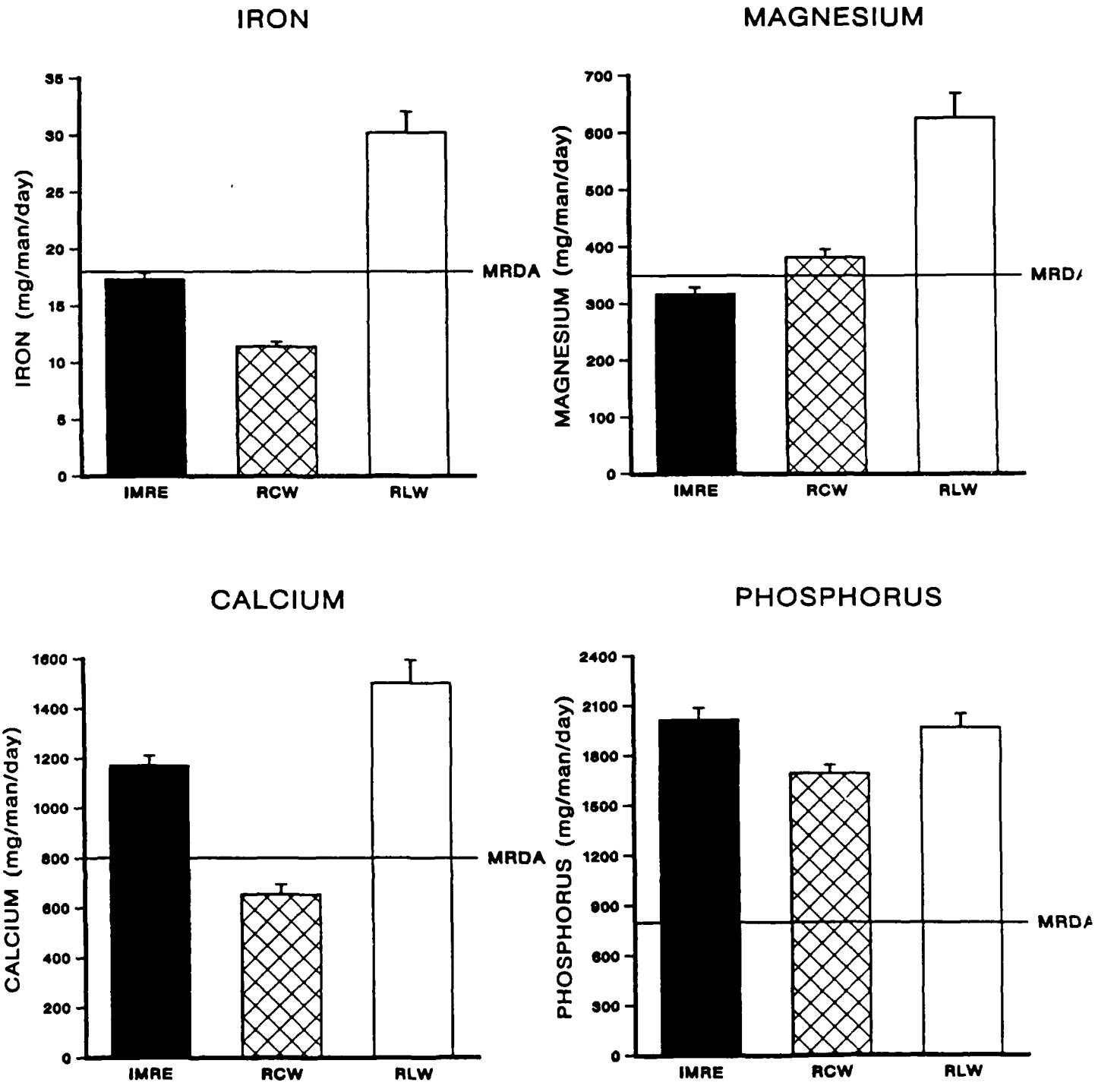


FIGURE 19

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

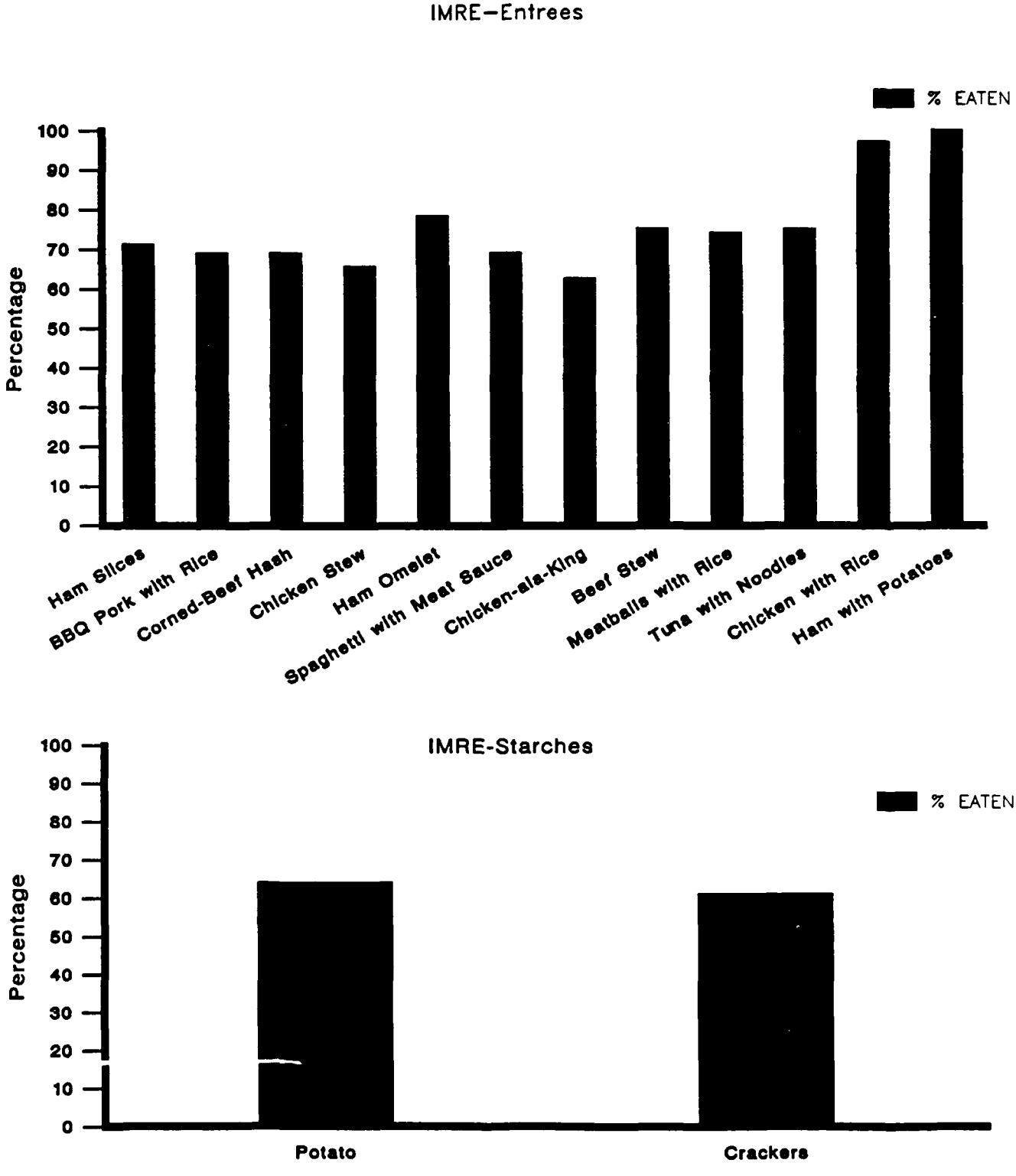
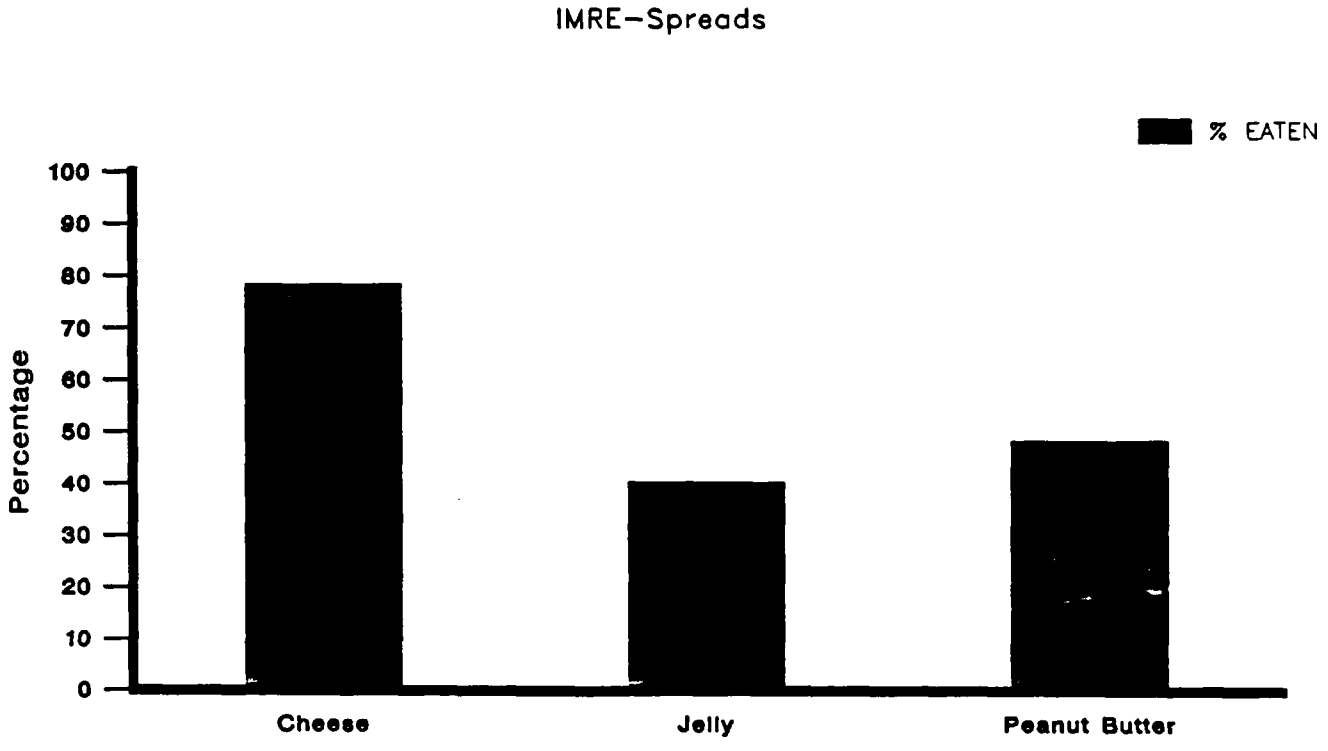


FIGURE 20

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST



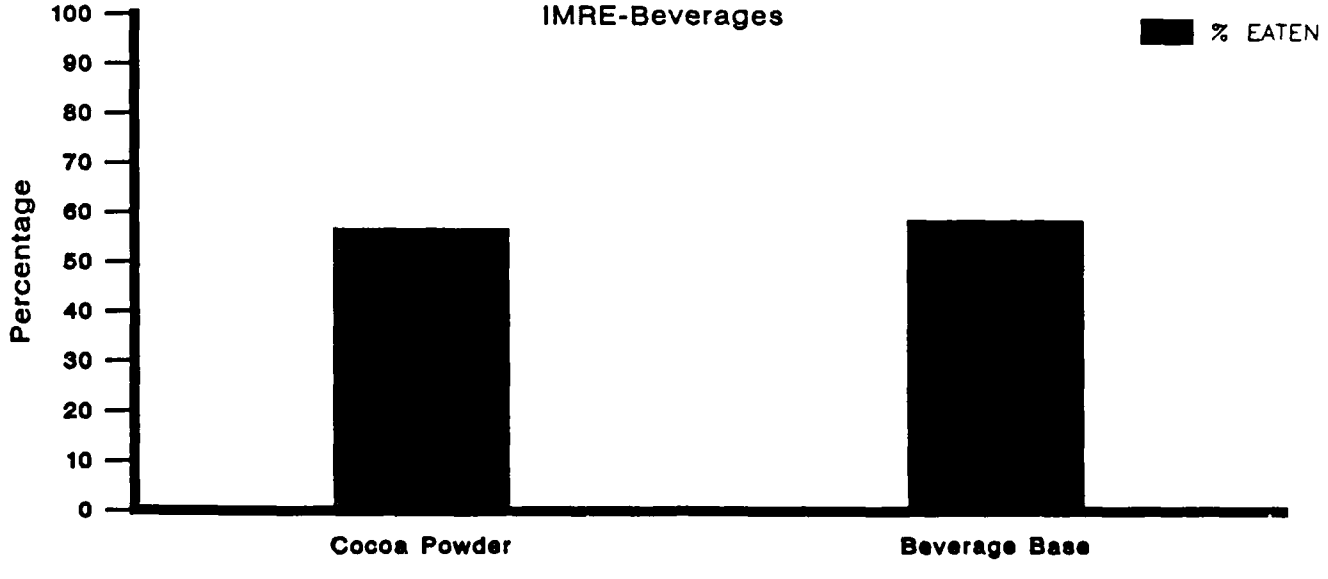
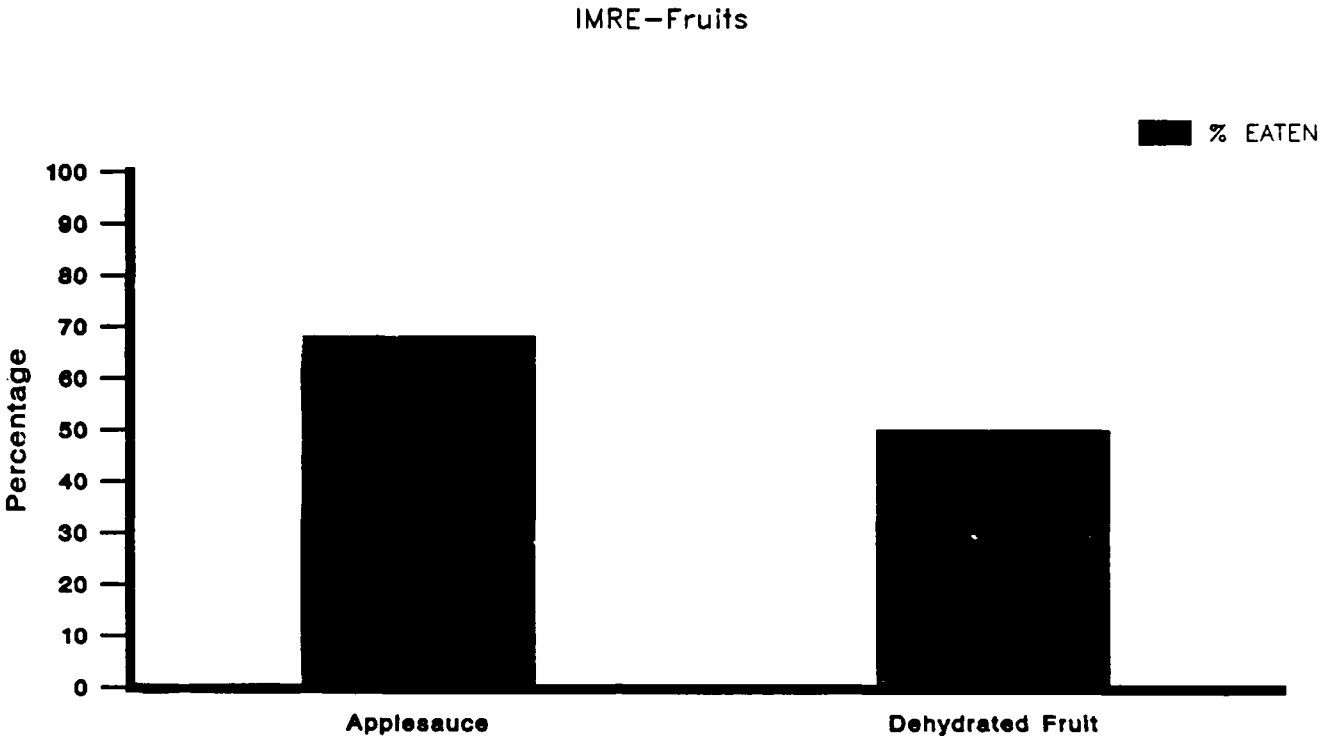


FIGURE 21

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST



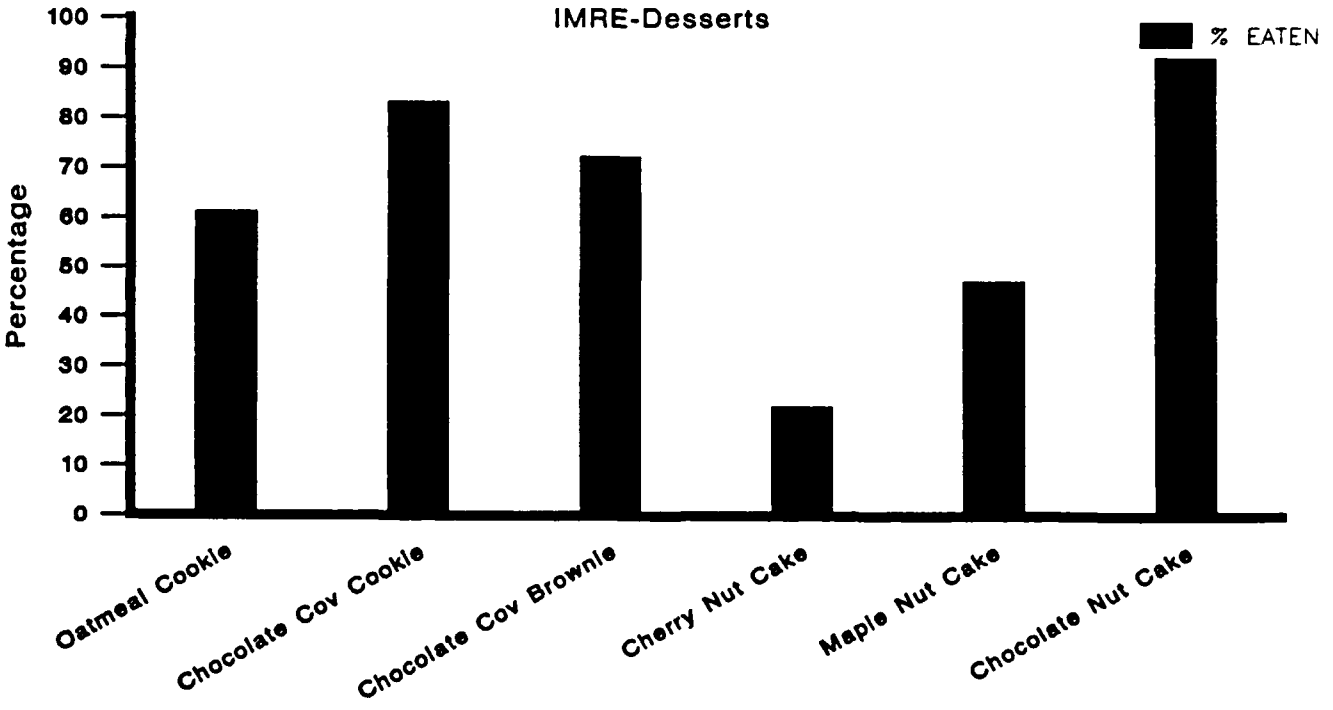
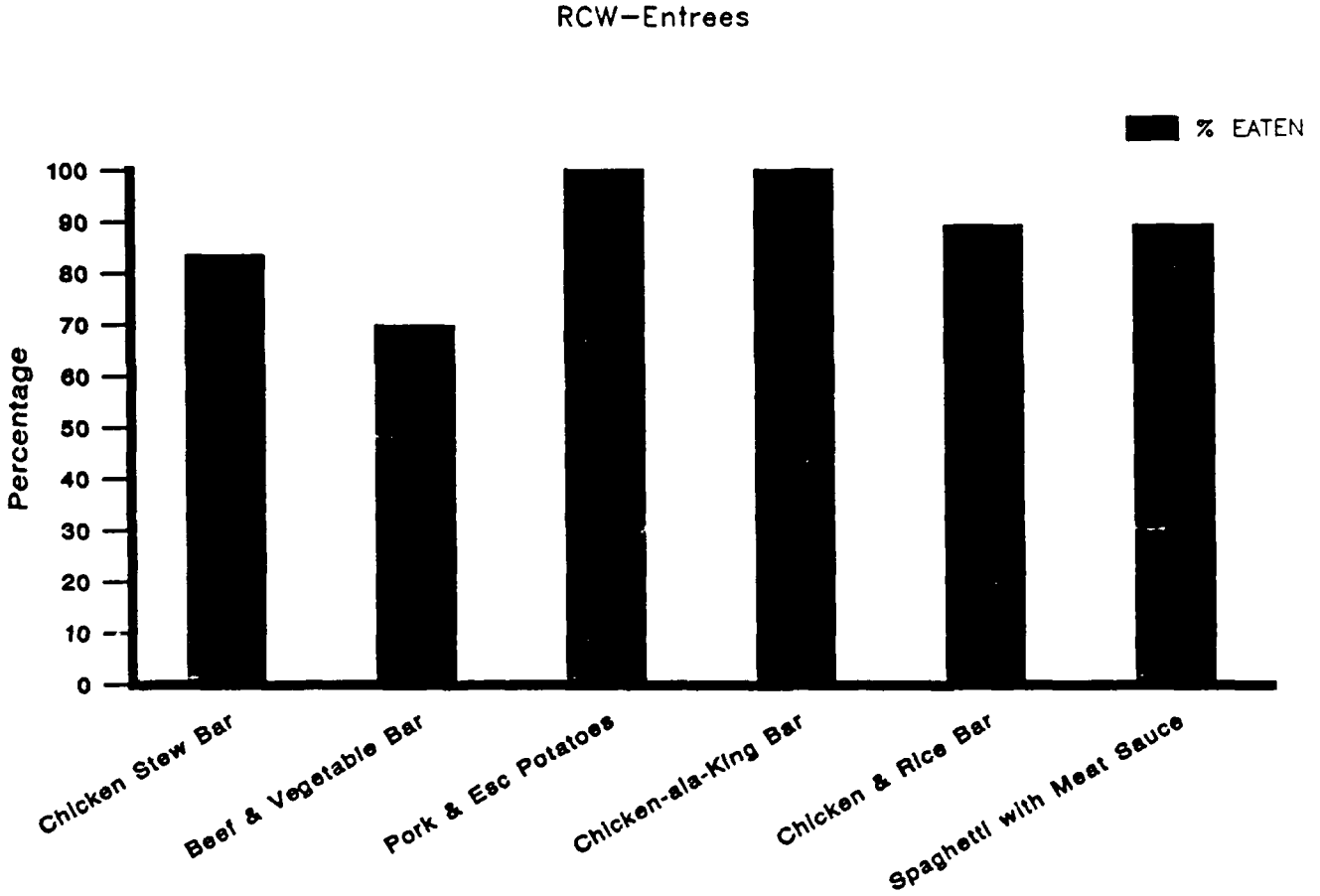


FIGURE 22

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST



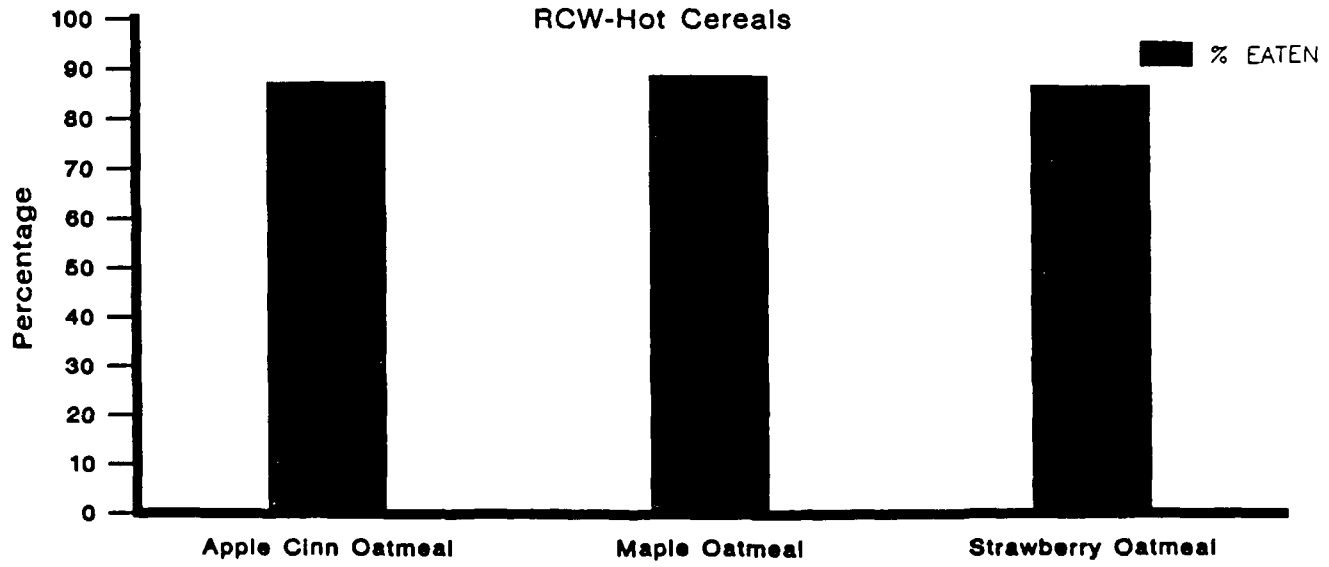
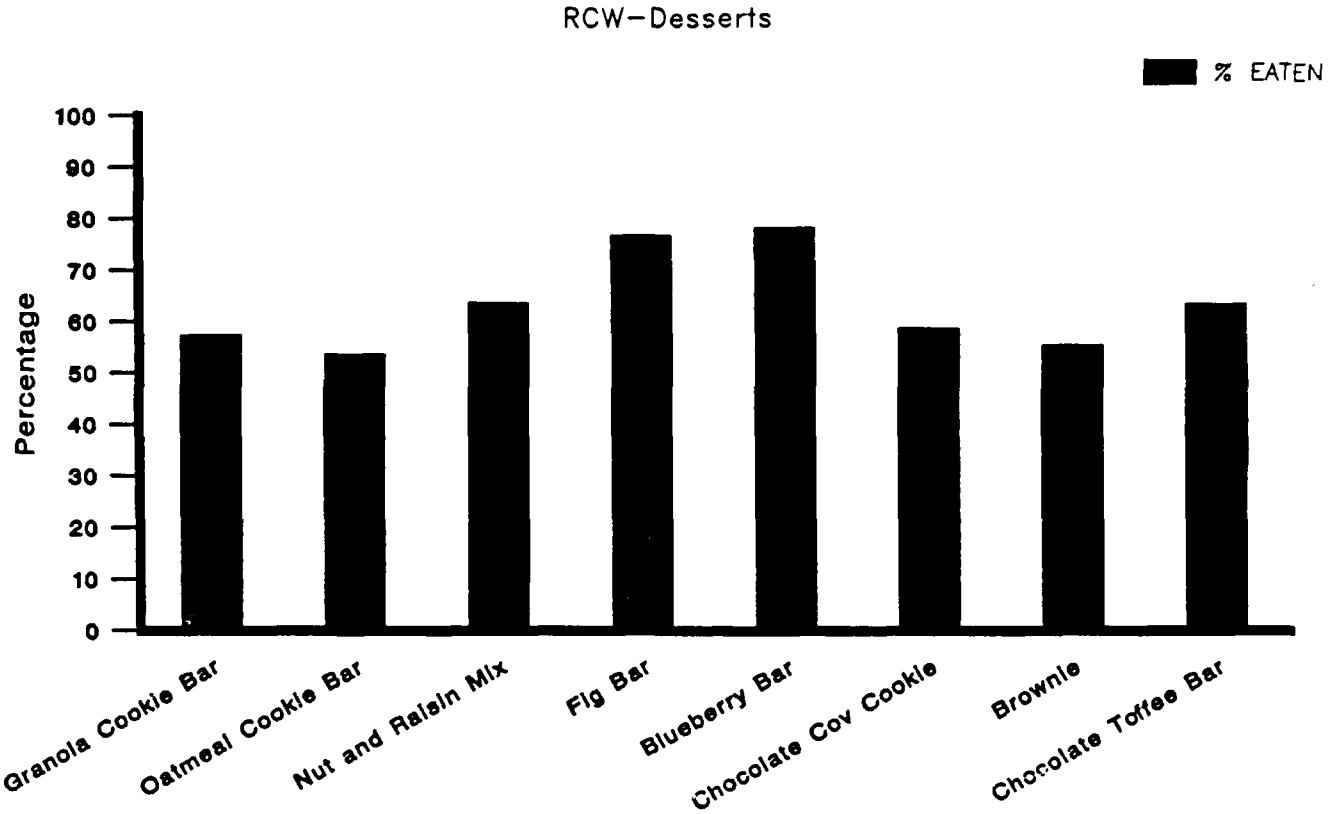


FIGURE 23

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST



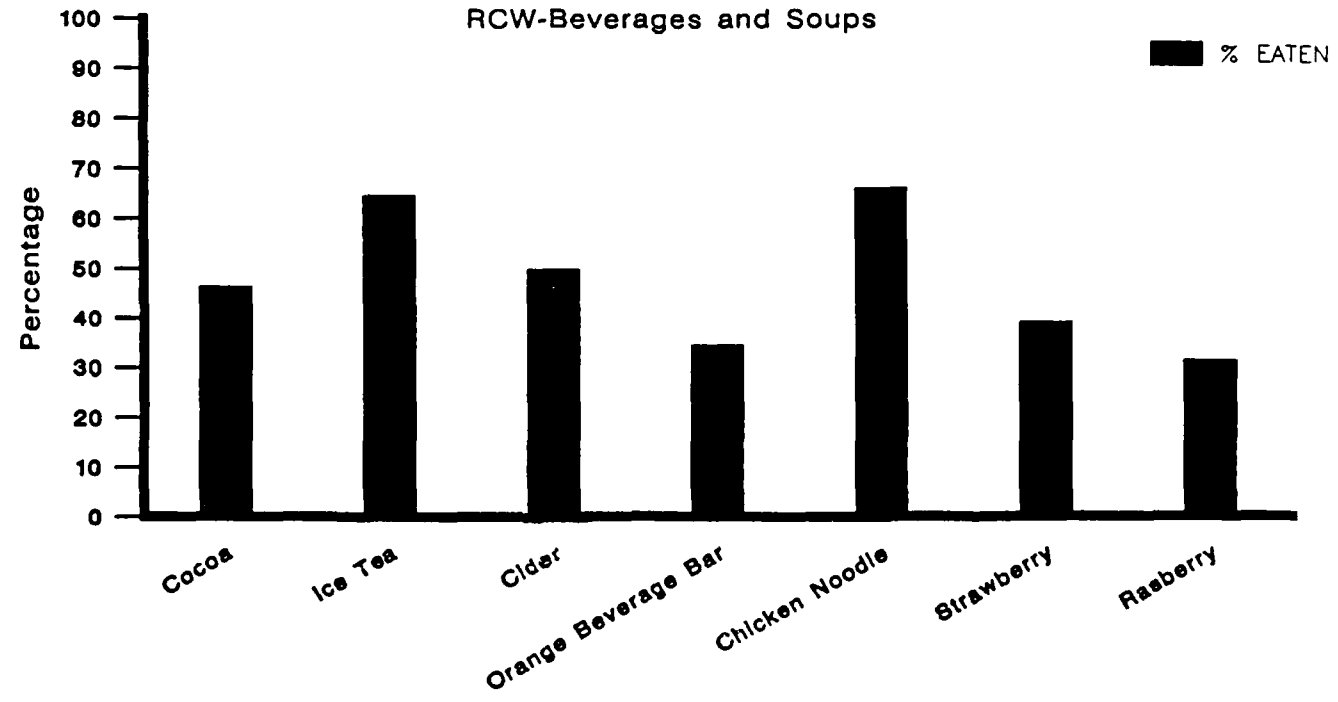
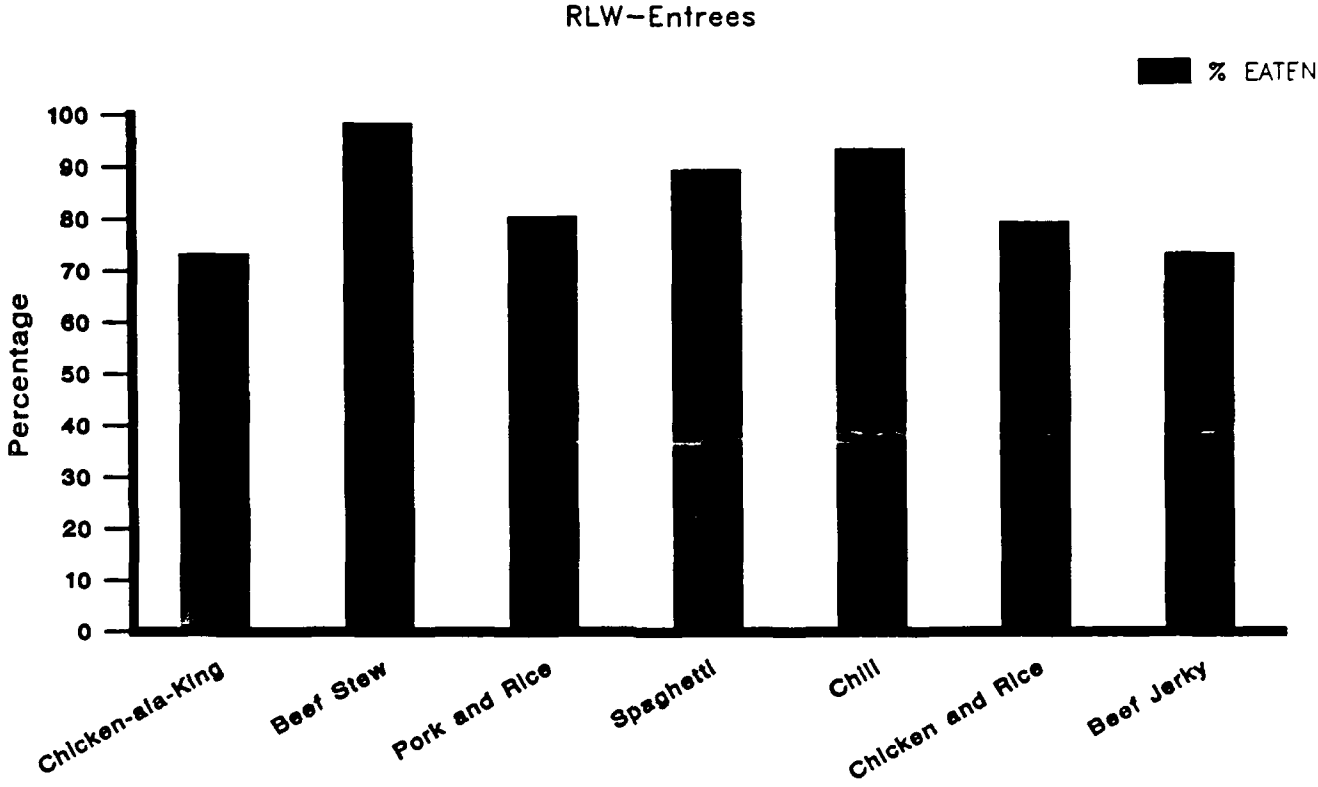


FIGURE 24

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST



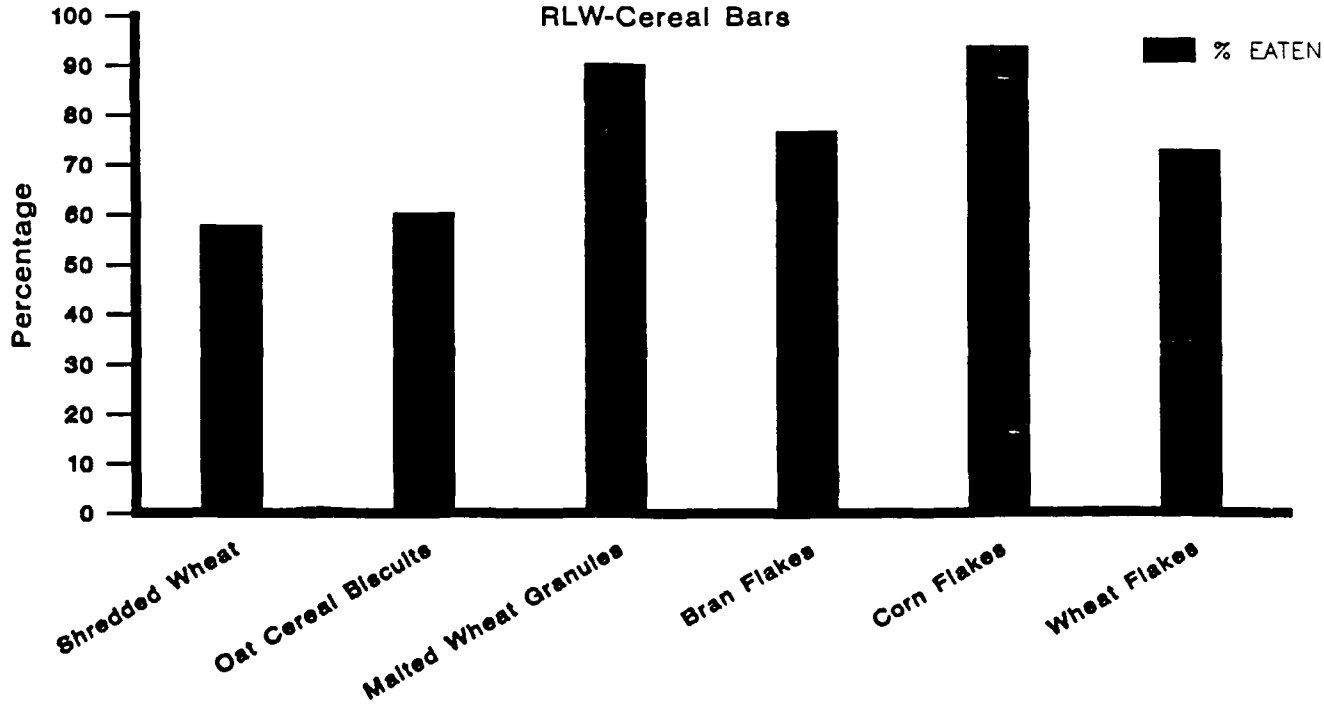
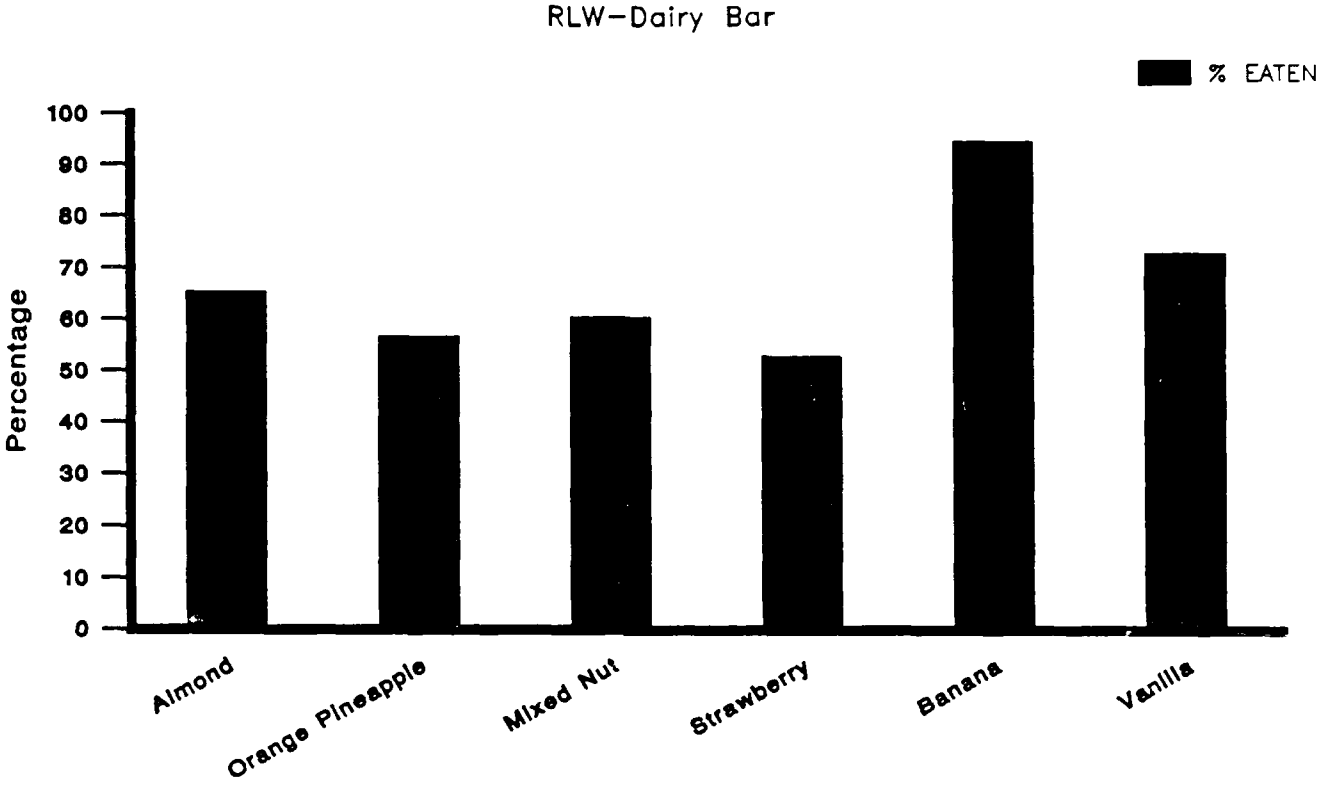


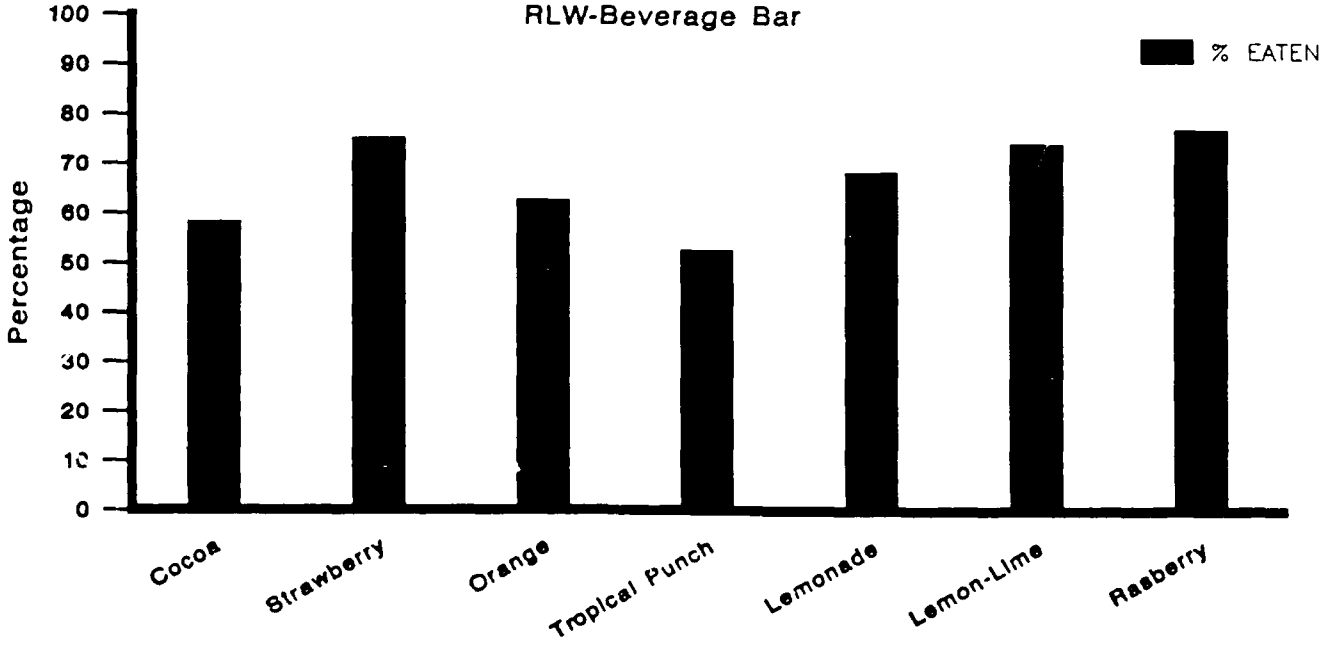
FIGURE 25

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST

FIGURE 26

1988 MARINE CORPS MOUNTAIN WARFARE RATION TEST





APPENDIX I

STRNC-WTS
22 October 1987

INFORMATION PAPER

SUBJECT: Meal, Ready-to-Eat, Individual

FACTS

1. The Meal, Ready-to-Eat, Individual (MRE) is the main operational ration used by the Department of Defense. It was developed by the U.S. Army Natick Research, Development and Engineering Center as a replacement for the previous ration, the Meal, Combat, Individual (MCI) and represents the culmination of an extensive scientific and engineering effort to bring about major improvements in the utility, acceptability and availability of individual operational rations.

2. Following highly successful service tests by the Army and Marine Corps, wherein soldiers consistently expressed very strong preference for the test meal consumed both hot and cold, the MRE was adopted as standard in 1975. After a large-scale production test in 1979-80, the Defense Personnel Support Center has been making annual procurements of the MRE that average 30 million meals a year.

3. Utilizing flexible, high-barrier packaging materials in place of metal cans, the MRE accomplishes a weight reduction of more than thirty percent of that of the MCI without impairing durability. Originally, each MRE meal weighed approximately 1.1 lbs. and provided one-third of the required daily food allowance including approximately 1200 calories.

4. Periodically, evolutionary changes are introduced into the MRE as they are identified. For example, feedback data from recent field studies and training exercises have indicated a need for increasing the entree quantity, adding a cold drink beverage powder and adding a popular condiment: liquid hot pepper sauce. When each of these changes is validated and approved by the Services, it is included in the ration during the next procurement cycle.

5. In 1986, the first of these changes was made by increasing the size of the original entrees, where feasible, to 8 ounces. This was done in 7 of the 12 original menus.

6. In 1987, the beverage powder was added to all menus and an individual serving of liquid hot pepper sauce was added to selected menus.

7. Other changes have been made for the future, such as including breakfast-type entrees, replacing nine original formulations with nine new formulations to satisfy changing tastes and utilizing all wet-pack entrees and starch component to improve fluid intake and lower water demand. With these changes, the MRE meals will average 1.5 lbs. and provide approximately 1300 calories. These improvements have been approved by the Army for procurement starting in 1988.

Raymond Mansur/5198

2 May 1988

MENUS AND COMPONENTS OF IMPROVED MEAL, READY-TO-EAT (MRE) VIII

MENU 1	MENU 2	MENU 3	MENU 4	MENU 5	MENU 6	MENU 7	MENU 8	MENU 9	MENU 10	MENU 11	MENU 12
Pork w/Rice in BBQ Sauce	Corned Beef Hash	Chicken Stew	Omelet w/Ham	Spaghetti w/Meat & Sauce	Chicken a la King	Beef Stew	Ham Slice	Meatballs in Spicy Tom Sauce	Tuna w/Noodles	Chicken w/Rice	Esc Potatoes w/Ham
Thermo-stabilized Applesauce	Freeze Dried Pears	Freeze Dried Peaches	Potatoes au Gratin		Freeze Dried Strawberries		Potatoes au Gratin	Freeze Dried Fruit Mix		Freeze Dried Peaches	Thermo-stabilized Applesauce
Jelly	Jelly	Peanut Butter	Cheese Spread	Cheese Spread	Peanut Butter	Peanut Butter	Jelly	Peanut Butter	Cheese Spread	Cheese Spread	Jelly
Crackers	Crackers	Crackers	Crackers	Crackers	Crackers	Crackers	Crackers	Crackers	Crackers	Crackers	Crackers
Candy	Oatmeal Cookie Bar	Candy	Oatmeal Cookie Bar	Maple Nut Cake	Candy	Cherry Nut Cake	Choc cvd Brownie	Choc cvd Cookie Bar	Chocolate Nut Cake	Choc cvd Cookie Bar	Choc cvd Brownie
Cocoa	Cocoa	Cocoa	Cocoa		Cocoa		Cocoa			Candy	Cocoa
Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd	Beverage Base, Pwd
Accessory Packet B	Accessory Packet A	Accessory Packet B	Accessory Packet A	Accessory Packet B	Accessory Packet A	Accessory Packet B	Accessory Packet A	Accessory Packet A	Accessory Packet A	Accessory Packet A	Accessory Packet A
Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon

ACCESSORY PACKET A

Coffee
Cream Sub.
Sugar
Salt
Towelette
Gum
Matches
Toilet Tissue

ACCESSORY PACKET B

Coffee
Cream Sub.
Sugar
Salt
Towelette
Hot Pepper Sauce
Gum
Matches
Toilet Tissue

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 1	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
PORK BBQ/RCE	143.68	32.27	25.13	3.81	39	288	3.67	828	796	48	2.06	4.54	79
APPLESAUCE	100.27	.23	.23	.18	5	9	.44	4	77	4		.05	
JELLY	9.70	.26	.05	.05	2	3	.11	13	11	2	.01		
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
CANDY AVER	1.78	4.20	6.43	.62	53	53	.73	106	90	15	.22		
COCOA BEV PD	1.10	2.80	6.95	1.99	67	196	.81	211	487	34	.43		
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
TABASCO SCE	.00	.10	.00					2	0	0			
SUM	257.97	47.06	48.44	8.64	475	671	6.86	1369	1688	123	3.20	4.59	79

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
PORK BBQ/RCE					.34	.32	6.4	.27	41	.45	2.49	21.91	443	227
APPLESAUCE	10		10	3	.01	.04	.2	.04	1			25.10	103	126
JELLY		.004	10	1	.00	.00	.0	.00				18.29	75	28
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
CANDY AVER					.02	.08	.1	.01	2		.80	34.32	212	47
COCOA BEV PD	2920		2920	48	1.31	.11	.2	1.13	5	.30	.30	29.69	192	43
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
TABASCO SCE							.0					4.90	20	5
SUM	2930	.004	2940	91	2.66	1.12	10.6	1.84	49	.86	4.51	205.42	1446	568

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 2	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
C BEEF HASH	157.56	29.78	13.06	3.06	25	181	3.40	878	445	34	2.15	6.80	86
PEARS DEHY	.42	.18	.04	.15	4	7	.13	9	71	5	.02	.04	
JELLY	9.70	.26	.05	.05	2	3	.11	13	11	2	.01		
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
GRANOLA BAR	2.38	4.57	6.49	.66	29	97	7.22	106	108	32			
COCOA BEV PD	1.10	2.80	6.95	1.99	67	196	.81	211	487	34	.43		
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
SUM	172.59	44.78	36.25	7.91	436	606	12.77	1422	1348	128	3.09	6.85	86

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
C BEEF HASH				2	.02	.20	5.2	.32	66	.68	.68	23.34	330	227
PEARS DEHY		.003	10		.01	.02	.1	.01	0		.19	14.22	58	15
JELLY		.004	10	1	.00	.00	.0	.00				18.29	75	28
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
GRANOLA BAR	2560		2560		.67	.46	7.6	2.12			.57	28.90	192	43
COCOA BEV PD	2920		2920	48	1.31	.11	.2	1.13	5	.30	.30	29.69	192	43
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
SUM	5480	.007	5500	91	2.99	1.37	16.8	3.96	71	1.09	2.65	185.64	1248	447

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 3	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
CHIX STEW	174.30	19.28	10.23	2.72	41	297	1.27	635	671	43	1.29	2.27	43
PEACHES FRDH	.36	.70	.07	.30	3	13	.31	9	113	5	.01	.00	
PEANUT BUT	.55	12.61	19.19	1.38	18	147	.71	218	289	70	.48		
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
CANDY AVER	1.78	4.20	6.43	.62	53	53	.73	106	90	15	.22		
COCOA BEV PD	1.10	2.80	6.95	1.99	67	196	.81	211	487	34	.43		
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
TABASCO SCE	.00	.10	.00					2	0	0			
SUM	179.53	46.89	52.53	9.00	492	829	4.93	1386	1877	188	2.91	2.27	43

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
CHIX STEW		1.948	3250		.05	.18	9.5	.23	86	.68	.45	20.28	250	227
PEACHES FRDH		.059	100	44	.01	.02	.5	.01	3		.42	13.56	58	15
PEANUT BUT	1710		1710	33	.87	.04	4.7	.08	27		1.40	8.79	258	43
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
CANDY AVER					.02	.08	.1	.01	2		.80	34.32	212	47
COCOA BEV PD	2920		2920	48	1.31	.11	.2	1.13	5	.30	.30	29.69	192	43
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
TABASCO SCE							.0					4.90	20	5
SUM	4630	2.007	7980	165	3.23	1.00	18.7	1.84	123	1.09	4.29	182.75	1391	471

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 4	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
HAM OMELET	127.86	22.59	13.00	3.21	44	362	2.28	936	332	26	1.99	1.70	338
POT AU GRAT	111.59	3.69	7.65	2.03	96	373	.37	587	272	14	1.13	.00	10
CHEESE SPR	18.17	5.68	15.77	1.72	158	235	.20	441	26	10	.65		39
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
GRANOLA BAR	2.38	4.57	6.49	.66	29	97	7.22	106	108	32			
COCOA BEV PD	1.10	2.80	6.95	1.99	67	196	.81	211	487	34	.43		
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
SUM	262.55	46.52	59.52	11.60	704	1386	11.97	2484	1450	137	4.68	1.70	388

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
HAM OMELET	500		500		.24	.39	3.4	.19	51	.51	1.02	3.44	221	170
POT AU GRAT	430	.051	520	1	.04	.11	1.0	.06	10		.85	16.80	151	142
CHEESE SPR	2910		2910	27	.88	.07	.0	1.38	4		.21	1.19	169	43
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
GRANOLA BAR	2560		2560		.67	.46	7.6	2.12			.57	28.90	192	43
COCOA BEV PD	2920		2920	48	1.31	.11	.2	1.13	5	.30	.30	29.69	192	43
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
SUM	9320	.051	9410	116	4.12	1.73	15.8	5.26	70	.92	3.87	151.23	1327	531

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 5	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
SPAG/MT SCE	171.37	23.45	7.19	4.29	77	211	3.70	1095	635	48	2.81	2.27	27
CHEESE SPR	18.17	5.68	15.77	1.72	158	235	.20	441	26	10	.65		39
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
MAPLE NUT CK	13.90	6.97	22.40	1.18	56	128	1.67	325	125	30	.61	.90	32
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
TABASCO SCE	.00	.10	.00					2	0	0			
SUM	204.88	43.39	55.02	9.18	600	696	6.66	2067	1012	108	4.55	3.17	98

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
SPAG/MT SCE		.578	960	2	.14	.27	5.2	.27	41	.68	2.49	20.50	241	227
CHEESE SPR	2910		2910	27	.88	.07	.0	1.38	4		.21	1.19	169	43
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
MAPLE NUT CK					.17	.19	1.6	.03	16		2.79	45.55	412	90
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
TABASCO SCE							.0					4.90	20	5
SUM	2910	.578	3870	69	2.17	1.10	10.5	2.06	61	.79	6.41	143.35	1242	456

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 6	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
CHIC ALAKING	171.52	30.03	14.41	3.27	34	229	1.84	965	415	34	1.82	2.27	84
STRAWBER SW	.13	.70	.16	.37	17	20	.51	5	131	11	.01		
PEANUT BUT	.55	12.61	19.19	1.38	18	147	.71	218	289	70	.48		
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
COCOA BEV PD	1.10	2.80	6.95	1.99	67	196	.81	211	487	34	.43		
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
SUM	174.76	53.34	50.37	9.00	445	715	4.97	1603	1548	170	3.21	2.27	84

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
CHIC ALAKING		.227	380		.05	.27	7.7	.16	32	.45	.68	7.76	281	227
STRAWBER SW		.007	10	14	.01	.01	.3	.02	7		.25	13.63	59	15
PEANUT BUT	1710		1710	33	.87	.04	4.7	.08	27		1.40	8.79	258	43
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
COCOA BEV PD	2920		2920	48	1.31	.11	.2	1.13	5	.30	.30	29.69	192	43
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
SUM	4630	.234	5020	135	3.21	1.01	16.5	1.77	71	.86	3.55	131.09	1191	419

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 7	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
BEEF STEW	169.05	30.51	10.08	3.90	34	207	3.54	1044	599	43	2.41		116
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
PEANUT BUT	.55	12.61	19.19	1.38	18	147	.71	218	289	70	.48		
CHERRY NTCK	17.86	6.62	16.96	1.09	51	104	1.57	304	105	26	.52	.90	23
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
TABASCO SCE	.00	.10	.00					2	0	0			
SUM	188.91	57.03	55.90	8.37	413	579	6.92	1773	1219	160	3.89	.90	138

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
BEEF STEW		1.267	2110	5	.05	.25	3.4	.27	34	1.59	1.82	13.46	267	227
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
PEANUT BUT	1710		1710	33	.87	.04	4.7	.08	27		1.40	8.79	258	43
CHERRY NTCK					.13	.14	1.2	.02	13		2.61	47.46	369	90
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
TABASCO SCE							.0					4.90	20	5
SUM	1710	1.267	3820	78	2.03	1.01	12.9	.75	74	1.70	6.74	145.82	1314	456

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 8	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
HAM SLICES	84.07	26.22	5.32	4.21	7	359	1.46	1364	407	27	2.92	2.38	81
POT AU GRAT	111.59	3.69	7.65	2.03	96	373	.37	587	272	14	1.13	.00	10
JELLY	9.70	.26	.05	.05	2	3	.11	13	11	2	.01		
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
BROWN CHCV	3.12	3.97	16.29	.54	34	72	1.44	78	121	30	.16	.50	16
COCOA BEV PD	1.10	2.80	6.95	1.99	67	196	.81	211	487	34	.43		
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	00	.03	0	0	.01	0	0	0	.00		
SUM	211.02	44.13	45.92	10.82	515	1125	5.29	2457	1524	128	5.13	2.88	107

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
HAM SLICES					.29	.26	5.1	.21	5	.36	.71	.00	153	119
POT AU GRAT	430	.051	520	1	.04	.11	1.0	.06	10		.85	16.80	151	142
JELLY		.004	10	1	.00	.00	.0	.00				18.29	75	28
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
BROWN CHCV	450		450	1	.40	.09	.4	.27	6		1.55	26.08	267	50
COCOA BEV PD	2920		2920	48	1.31	.11	.2	1.13	5	.30	.30	29.69	192	43
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
SUM	3800	.055	3900	91	3.02	1.15	10.4	2.06	25	.76	4.33	162.07	1238	473

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 9	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
MEATBLS/RICE	146.81	32.64	15.45	5.40	48	293	4.79	1399	776	52	3.20	6.80	54
FRUIT MX DEH	.42	.49	.13	.23	9	12	.27	6	104	7	.01	.15	
PEANUT BUT	.55	12.61	19.19	1.38	18	147	.71	218	289	70	.48		
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
COOKIES CHCV	.74	3.03	12.17	.53	29	70	.99	94	90	22	.17	.43	11
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
SUM	149.96	55.96	56.60	9.54	413	644	7.86	1922	1484	172	4.35	7.38	66

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
MEATBLS/RICE					.07	.27	7.3	.25	32	.91	5.44	26.51	376	227
FRUIT MX DEH		.023	40	77	.01	.02	.3	.01	6		.15	13.73	58	15
PEANUT BUT	1710		1710	33	.87	.04	4.7	.08	27		1.40	8.79	258	43
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
COOKIES CHCV	490		490	2	.45	.08	.3	.27	7		.89	26.06	226	43
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
SUM	2200	.023	2240	152	2.38	.98	16.2	.99	72	1.02	8.80	146.30	1318	418

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 10	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
TUNA/NOODLES	172.10	26.04	8.89	2.02	29	229	2.00	603	220	39	1.36	.00	41
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
CHEESE SPR	18.17	5.68	15.77	1.72	158	235	.20	441	26	10	.65		39
CH NUT CAKE	14.79	12.57	21.79	1.17	51	130	1.98	290	152	37	.52	.90	31
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
SUM	206.50	51.48	56.11	6.90	548	716	5.27	1538	624	106	3.01	.90	111

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
TUNA/NOODLES	600		600		.18	.14	6.8	.23	34	.45	2.04	17.76	255	227
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
CHEESE SPR	2910		2910	27	.88	.07	.0	1.38	4		.21	1.19	169	43
CH NUT CAKE					.14	.14	1.4	.02	17		2.79	39.68	405	90
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
SUM	3510	.000	3510	67	2.19	.92	11.9	2.01	55	.56	5.96	129.84	1230	451

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 11	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
CHIX/RICE	165.18	30.62	10.95	2.95	16	293	2.43	1039	458	36	2.22	2.27	79
PEACHES FRDH	.36	.70	.07	.30	3	13	.31	9	113	5	.01	.00	
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
CHEESE SPR	18.17	5.68	15.77	1.72	158	235	.20	441	26	10	.65		39
COOKIES CHCV	.74	3.03	12.17	.53	29	70	.99	94	90	22	.17	.43	11
CANDY AVER	1.78	4.20	6.43	.62	53	53	.73	106	90	15	.22		
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
SUM	187.67	51.43	55.06	8.11	568	787	5.75	1893	1003	109	3.76	2.69	130

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
CHIX/RICE					.14	.20	12.7	.39	100	.23	.68	17.10	289	227
PEACHES FRDH		.059	100	44	.01	.02	.5	.01	3		.42	13.56	58	15
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
CHEESE SPR	2910		2910	27	.88	.07	.0	1.38	4		.21	1.19	169	43
COOKIES CHCV	490		490	2	.45	.08	.3	.27	7		.89	26.06	226	43
CANDY AVER					.02	.08	.1	.01	2		.80	34.32	212	47
BEVERAGE BSE				25			.					28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
SUM	3400	.059	3500	113	2.47	1.02	17.3	2.44	116	.33	3.92	163.44	1355	466

RECORD OF NUTRITIVE VALUES MRE-VIII

05/01/87

MENU 12	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
HAM/POTATOES	174.82	23.63	8.46	3.97	18	356	1.61	1204	576	36	2.54	2.27	50
APPLESAUCE	100.27	.23	.23	.18	5	9	.44	4	77	4		.05	
CRACKERS	.95	4.43	5.58	1.29	261	52	.72	184	72	12	.44		
JELLY	9.70	.26	.05	.05	2	3	.11	13	11	2	.01		
BROWN CHCV	3.12	3.97	16.29	.54	34	72	1.44	78	121	30	.16	.50	16
COCOA BEV PD	1.10	2.80	6.95	1.99	67	196	.81	211	487	34	.43		
BEVERAGE BSE	.12	2.48	2.99	.22	36	33	.12	2	2	0	.00	.00	
COFFEE INSTA	.06	.00	.00	.24	4	10	.14	2	81	8	.00		
CREAM SUB ND	.30	.28	1.09	.22	7	28	.11	16	71	1	.03		
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00		
SUM	290.45	38.09	41.63	8.72	435	757	5.51	1714	1498	127	3.62	2.82	66

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
HAM/POTATOES	280		280		.36	.25	7.0	.36	50	.20	.68	15.92	234	227
APPLESAUCE	10		10	3	.01	.04	.2	.04	1			25.10	103	126
CRACKERS	0	.000	0	0	.98	.53	2.8	.38	0	.11	.91	32.75	199	45
JELLY		.004	10	1	.00	.00	.0	.00				18.29	75	28
BROWN CHCV	450		450	1	.40	.09	.4	.27	6		1.55	26.08	267	50
COCOA BEV PD	2920		2920	48	1.31	.11	.2	1.13	5	.30	.30	29.69	192	43
BEVERAGE BSE				25								28.19	150	34
COFFEE INSTA				15		.01	.8	.00				2.19	9	3
CREAM SUB ND						.03		.00				2.11	19	4
SUGAR	0	.000	0	0	.00	.00	.0	.00				5.97	24	6
SUM	3660	.004	3670	92	3.07	1.06	11.5	2.19	61	.63	3.44	186.29	1272	565

Note 1: Carbohydrate has been computed by difference.

Note 2: Cocoa beverage powder, cheese spread and the coatings for oatmeal cookies and brownies are fortified with Vitamin A, ascorbic acid, thiamin and pyridoxine. Peanut butter is fortified with Vitamin A, ascorbic acid and thiamin. Coffee is fortified with ascorbic acid. Crackers are fortified with calcium carbonate, thiamin, riboflavin, niacin and pyridoxine.

Note 3: Calories have been computed using 4, 9, 4, calorie factors.

Note 4: No adjustments have been made to compensate for nutritional losses during storage.

Note 5: Blanks in columns reporting NaCl, zinc, cholesterol, folacin, vitamins B12 and E data indicate missing data, not zero values.

INFORMATION PAPER

STRNC-WTP
23 Mar 88

SUBJECT: Ration, Cold Weather (Marine Corps Artic Ration)

1. In January 1983, a program was established at Natick RD&E Center to develop an operational cold weather ration. The requirement originated with the Marine Corps, which annually deploys units to Norway for cold weather training. Subsistence items and rations presently available are unsatisfactory because they are too bulky or heavy, produce 50 percent more trash, contain excesive sodium and protein, or the high water content makes them susceptible to freezing, which affects consumption and may degrade packaging integrity.

2. The Food Packet, Assault (FPA), type classified in March 1986, was the basis for the initial Ration, Cold Weather (RCW) concept. It included FPA food bars supplemented by components, which provide extra calories and drink mixes to encourage increased water consumption.

3. Primary essential characteristics are: 4500 kilocalories per menu; will not freeze; contain entrees, snacks, and numerous hot drinks; flat, flexible waterproof packaging; requires little preparation; lighter and smaller than four Meal, Ready-to-Eat, Individual (MRE); the mean sodium content per menu must be within the guidelines of Army Regulation 40-25.

4. Prototype testing includes two Marine NATO exercises, climatic chamber tests by Navy Submarine Medical Research Lab, three informal evaluations by Navy SEALs and the U.S. Army Health Clinic, Fort Greely, AK, two technical feasibility tests by Cold Regions Test Center, TECOM, and one operational test each by 10th Special Forces, the Marine Corps Mountain Warfare Training Center, and the 6th Infantry Division. Results indicate that the prototype meets requirements, is more logistically supportable and acceptable then the MRE for cold weather feeding, but water discipline needs more command emphasis.

5. The U.S. Army Quartermaster School (QMS) initiated the Army's requirement for a cold weather ration. A Joint Working Group (JWG) meeting held in April 1987 addressed a second draft of the Operational and Organizational (O&O) Plan and a final draft was approved in September 1988. The Army pursued the adoption of the U.S.M.C. ROC (Required Operational Capability); however at a Test Integration Working Group meeting held 16 March 88 to discuss large scale testing of the RCW. the QMS representatives stated that the Army may have no requirement for the RCW. QMS is currently revalidating the Army's requirement for a cold weather ration.

6. Current efforts include: Providing the Defense Personnel Support Center with technical assistance for the U.S.M.C. FY88 procurement (221,000 rations) and monitoring the U.S. Army's position on the RCW via close coordination with QMS.

MAJ Schilling/AV256-4050/

PHILIP BRANDLER
Director, Food Engineering Directorate

MENU 1	MENU 2	MENU 3	MENU 4	MENU 5	MENU 6
CHICKEN STEW	BEEF STEW	POTATO/PORK	CHIX ALAKING	CHICKEN/RICE	SPAG/MEAT SC
OAT/STRAWBER	OAT/APPLE/CN	OAT/APPLE/CN	OAT/MAPLE/BS	OAT/STRAWBER	OAT/MAPLE/BS
COOKIE CO/CH	BROWNIE CHCV	BROWNIE CHCV	COOKIE CO/CH	BROWNIE CHCV	COOKIE CO/CH
GRANOLA BAR	GRANOLA BAR	GRANOLA BAR	GRANOLA BAR	GRANOLA BAR	GRANOLA BAR
OATML COOKIE	OATML COOKIE	OATML COOKIE	OATML COOKIE	OATML COOKIE	OATML COOKIE
BLUEBERRY BR	FIG BAR	FIG BAR	FIG BAR	BLUEBERRY BR	BLUEBERRY BR
RAISIN/NUT	RAISIN/NUT	RAISIN/NUT	RAISIN/NUT	RAISIN/NUT	RAISIN/NUT
CHOC W/TOFFE	CHOC W/TOFFE	CHOC W/TOFFE	CHOC W/TOFFE	CHOC W/TOFFE	CHOC W/TOFFE
ORANGE BEV	ORANGE BEV	ORANGE BEV	ORANGE BEV	ORANGE BEV	ORANGE BEV
COCOA BEV PD	COCOA BEV PD	COCOA BEV PD	COCOA BEV PD	COCOA BEV PD	COCOA BEV PD
LEMON TEA	LEMON TEA	LEMON TEA	LEMON TEA	LEMON TEA	LEMON TEA
CIDER MIX	CIDER MIX	CIDER MIX	CIDER MIX	CIDER MIX	CIDER MIX
FR/SOUP/STRA	FR/SOUP/RASP	FR/SOUP/STRA	FR/SOUP/RASP	FR/SOUP/STRA	FR/SOUP/RASP
CHIX NDL SUP	CHIX NDL SUP	CHIX NDL SUP	CHIX NDL SUP	CHIX NDL SUP	CHIX NDL SUP

RECORD OF NUTRITIVE VALUES RATION COLD WEATHER

04/15/88

TOTALS	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
1	41.13	120.25	152.10	24.34	1088	2368	15.03	4887	4070	570	10.57	7.08	182
2	42.35	122.08	144.16	23.30	1151	2418	18.86	4493	4793	602	9.53	16.18	129
3	43.06	115.52	156.23	24.64	1406	2556	16.62	4693	4735	593	10.07	13.78	174
4	39.68	124.08	154.62	22.64	1195	2355	15.33	4179	4762	588	9.39	8.91	268
5	42.94	127.33	144.38	23.34	1056	2400	14.96	4642	4002	567	9.88	7.15	195
6	42.40	112.19	144.24	23.17	1238	2338	18.70	4386	4962	597	9.88	15.53	149
MEAN	41.93	120.24	149.29	23.57	1189	2406	16.58	4547	4554	586	9.89	11.44	183
MEAL REQUIREMENTS 1/3 AR 40-25		33.33	53.3		267	267	6.0	1667-2334	625-1825	133		5.0	

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
1	9970	3.176	15270	259	6.05	1.81	38.6	4.18	220	.84	23.04	656.18	4475	994
2	9740	4.130	16630	260	6.22	2.04	28.9	4.25	218	1.44	18.03	667.11	4454	999
3	10100	.062	10210	262	6.91	2.24	24.8	4.20	196	1.08	17.96	659.54	4506	999
4	10330	.064	10440	259	6.07	2.00	38.4	4.25	221	.84	22.42	650.98	4492	992
5	9740	.052	9830	260	6.20	1.81	38.9	4.23	200	.84	19.48	663.02	4461	1001
6	9970	.791	11290	261	6.16	2.06	26.7	4.19	239	1.92	19.97	671.99	4435	994
MEAN	9975	1.379	12278	260	6.27	1.99	32.7	4.22	216	1.16	20.15	661.47	4470	997
MEAL REQUIREMENTS 1/3 AR 40-25			1670	20	0.60	0.73	8.0(N.E.)	0.73	133	1.0	3.3	146.7	1200	

PERCENT OF CALORIES FROM: PROTEIN - 11 PERCENT
FAT - 30 PERCENT
CHO - 59 PERCENT

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MENU 1	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
CHICKEN STEW	1.56	56.58	22.20	7.91	73	563	2.00	2296	928	85	5.32	1.20	125
OAT/STRAWBER	7.52	10.14	5.35	2.39	41	381	1.99	295	569	81	.27	1.25	
COOKIE CO/CH	1.06	2.71	12.17	.38	36		.73	82	104	20	.24	.43	21
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
BLUEBERRY BR	9.51	1.80	6.81	.53	10	25	.75	204	55	7	.35	.00	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/STRA	1.23	.13	.33	.08	12	1	.21	19	13	4	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	41.13	120.25	152.10	24.34	1088	2368	15.03	4887	4070	570	10.57	7.08	182

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
CHICKEN STEW		3.124	5210		.31	.28	24.6	.36	40	.24	5.40	31.75	553	120
OAT/STRAWBER	380	.021	420		.36	.09	.6	.06	25		2.75	99.60	487	125
COOKIE CO/CH	680		680		.20	.06	.2	.25	14		1.63	26.68	227	43
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
BLUEBERRY BR		.006	10		.05	.06	.9	.01	2		.36	41.35	234	60
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/STRA				6	.50	.02	.0	.01	2		.15	48.21	196	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	9970	3.176	15270	259	6.05	1.81	38.6	4.18	220	.84	23.04	656.18	4475	994

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MENU 2	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
BEEF STEW	1.49	55.74	10.14	6.52	100	514	4.55	1876	1050	85	4.14	8.40	76
OAT/APPLE/CN	7.87	10.99	6.21	2.22	49	399	2.19	284	1041	96	32	2.50	
BROWNIE CHCV	3.12	3.97	16.29	.54	34	72	1.44	78	121	30	.16	.50	16
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
FIG BAR	8.35	2.41	5.78	.88	40	36	1.15	251	164	14	.53	.58	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/RASP	1.27	.09	.50	.09	13	1	.19	14	17	3	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	42.35	122.08	144.16	23.30	1151	2418	18.86	4493	4793	602	9.53	16.18	129

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
BEEF STEW		4.068	6780		.29	.38	14.2	.37	47	.84	.84	46.12	499	120
OAT/APPLE/CN	380	.027	430		.38	.09	.8	.09	24		2.50	97.70	491	125
BROWNIE CHCV	450		450	1	.40	.09	.4	.27	6		1.55	26.08	267	50
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
FIG BAR		.010	20		.03	.15	1.3	.02	2		.29	40.58	224	58
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/RASP				6	.50	.02	.0	.01	2		.10	48.04	197	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	9740	4.130	16630	260	6.22	2.04	28.9	4.25	218	1.44	18.03	667.11	4454	999

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MENU 3	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
POTATO/PORK	2.24	49.14	22.38	7.86	356	652	2.28	2070	996	76	4.68	6.00	121
OAT/APPLE/CN	7.87	10.99	6.21	2.22	49	399	2.19	284	1041	96	.32	2.50	
BROWNIE CHCV	3.12	3.97	16.29	.54	34	72	1.44	78	121	30	.16	.50	16
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
FIG BAR	8.35	2.41	5.78	.88	40	36	1.15	251	164	14	.53	.58	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.12	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/STRA	1.23	.13	.33	.08	12	1	.21	19	13	4	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	43.06	115.52	156.23	24.64	1406	2556	16.62	4693	4735	593	10.07	13.78	174

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
POTATO/PORK	360		360	2	.98	.59	10.1	.32	24	.48	.72	38.38	551	120
OAT/APPLE/CN	380	.027	430		.38	.09	.8	.09	24		2.50	97.70	491	125
BROWNIE CHCV	450		450	1	.40	.09	.4	.27	6		1.55	26.08	267	50
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
FIG BAR		.010	20		.03	.15	1.3	.02	2		.29	40.58	224	58
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/STRA				6	.50	.02	.0	.01	2		.15	48.21	196	50
CHIX NDL SUP					.12	.06	1.9	02	7		.13	10.09	69	18
SUM	10100	.062	10210	262	6.91	2.24	24.8	4.20	196	1.08	17.96	659.54	4506	999

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MENU 4	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
CHIX ALAKING	1.38	58.50	24.60	5.99	130	530	1.80	1606	892	80	3.78	1.20	210
OAT/MAPLE/BS	7.37	11.49	6.32	2.25	61	390	2.11	235	1185	98	.46	2.50	
COOKIE CO/CH	1.06	2.71	12.17	.38	36		.73	82	104	20	.24	.43	21
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
FIG BAR	8.35	2.41	5.78	.88	40	36	1.15	251	164	14	.53	.58	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/RASP	1.27	.09	.50	.09	13	1	.19	14	17	3	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	39.68	124.08	154.62	22.64	1195	2355	15.33	4179	4762	588	9.39	8.91	268

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
CHIX ALAKING	360		360		.31	.36	23.8	.41	31	.24	5.40	29.53	574	120
OAT/MAPLE/BS	380	.029	430		.40	.10	.9	.07	34		2.25	97.56	493	125
COOKIE CO/CH	680		680		.20	.06	.2	.25	14		1.63	26.68	227	43
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
FIG BAR		.010	20		.03	.15	1.3	.02	2		.29	40.58	224	58
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/RASP				6	.50	.02	.0	.01	2		.10	48.04	197	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	10330	.064	10440	259	6.07	2.00	38.4	4.25	221	.84	22.42	650.98	4492	992

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MENU 5	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
CHICKEN/RICE	1.31	62.40	10.36	6.74	43	523	1.22	2056	844	72	4.72	1.20	142
OAT/STRAWBER	7.52	10.14	5.35	2.39	41	381	1.99	295	569	81	.27	1.25	
BROWNIE CHCV	3.12	3.97	16.29	.54	34	72	1.44	78	121	30	.16	.50	16
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
BLUEBERRY BR	9.51	1.80	6.81	.53	10	25	.75	204	55	7	.35	.00	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/STRA	1.23	.13	.33	.08	12	1	.21	19	13	4	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	42.94	127.33	144.38	23.34	1056	2400	14.96	4642	4002	567	9.88	7.15	195

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
CHICKEN/RICE					.26	.25	24.7	.38	28	.24	1.92	39.19	500	120
OAT/STRAWBER	380	.021	420		.36	.09	.6	.06	25		2.75	99.60	487	125
BROWNIE CHCV	450		450	1	.40	.09	.4	.27	6		1.55	26.08	267	50
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
BLUEBERRY BR		.006	10		.05	.06	.9	.01	2		.36	41.35	234	60
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/STRA				6	.50	.02	.0	.01	2		.15	48.21	196	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	9740	.052	9830	260	6.20	1.81	38.9	4.23	200	.84	19.48	663.02	4461	1001

RECORD OF NUTRITIVE VALUES RATION COLD WEATHER

04/15/88

MENU 6	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
SPAG/MEAT SC	2.94	47.22	13.20	6.86	202	524	5.58	1860	1200	96	4.44	8.40	91
OAT/MAPLE/BS	7.37	11.49	6.32	2.25	61	390	2.11	235	1185	98	.46	2.50	
COOKIE CO/CH	1.06	2.71	12.17	.38	36		.73	82	104	20	.24	.43	21
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.03	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
BLUEBERRY BR	9.51	1.80	6.81	.53	10	25	.75	204	55	7	.35	.00	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/RASP	1.27	.09	.50	.09	13	1	.19	14	17	3	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	42.40	112.19	144.24	23.17	1238	2338	18.70	4386	4962	597	9.88	15.53	149

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
SPAG/MEAT SC		.731	1220	2	.38	.52	12.5	.36	49	1.32	2.88	49.78	507	120
OAT/MAPLE/BS	380	.029	430		.40	.10	.9	.07	34		2.25	97.56	493	125
COOKIE CO/CH	680		680		.20	.06	.2	.25	14		1.63	26.68	227	43
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
BLUEBERRY BR		.006	10		.05	.06	.9	.01	2		.36	41.35	234	60
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/RASP				6	.50	.02	.0	.01	2		.10	48.04	197	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	9970	.791	11290	261	6.16	2.06	26.7	4.19	239	1.92	19.97	671.99	4435	994

STRNC-WTP (70-1ff)
17 May 1988
Carol Shaw
AV 256-4507

INFORMATION PAPER

SUBJECT: Ration Lightweight - 30 Day (RLW-30)

1. Requirement: An operational need exists for a light weight, calorie dense ration that will sustain the Special Operations Forces (SOF) soldier in clandestine operations up to 30 days without resupply. Subsistence items/rations that are presently available are too bulky or heavy, denying space needed for mission essential equipment.

2. Ration Concepts:

a. Design: This ration will be a pre-assembled, restricted ration packaged in a CB-proof, modular packet that can be eaten as is or with minimum preparation and a limited water supply. The desired ration characteristics were set by the SOF and the Office of the Surgeon General (OTSG). The ration can weigh no more than one pound (454 grams) per day and can be no more than 45 cu. in. (737cc) in volume per day.

b. Modularization: The RLW-30 will have a six day menu cycle with a separate accessory packet for every six days. Thirty ration packets and five accessory packets will be modularized into a compact package suitable for aero-delivery or through normal supply channels.

3. Program Objectives:

a. Establish concepts, operational characteristics, salient features, packaging configuration, and nutritional requirements for a specialized RLW-30 for use by SOF.

b. Evaluate components of current rations and components under development to determine suitability for specialized packet.

c. Adapt components to fit design criteria.

d. Develop calorie dense new items to supplement existing components.

e. Develop a packaging system to meet design criteria.

f. Demonstrate advanced ration prototype that meets design criteria.

g. Field the ration under an accelerated time cycle.

4. Status: Prototype RLW-30 packets have been developed and successfully evaluated in field exercises for seven and 12 day periods. A successful 30-day test (DT/OT) was conducted in 1QFY87. Type classification is FY90.

The current prototype RLW-30 packets without accessories have the following characteristics:

Daily Ration Packet

Weight (g)	454 grams
Volume (cu. in.)	45
kcalories	2112
CHO (g)	198
Protein (g)	76
Fat (g)	114

MENU 1	MENU 2	MENU 3	MENU 4	MENU 5	MENU 6
FOOD ITEM	FOOD ITEM	FOOD ITEM	FOOD ITEM		FOOD ITEM
CHICKEN A LA KING	BEEF STEW	PORK & RICE	CHICKEN AND RICE	SPAGHETTI	CHILI
NACHO CHEESE BREAD	TAMALE BREAD	PIZZA BREAD	BACON CHEESE BREAD	COCONUT BREAD	ORANGE NUT BREAD
ALMOND DAIRY BAR	STRAWBERRY DAIRY	VANILLA DAIRY BAR	ON-PINE-COCO DAIRY	MIXED NUT DAIRY BAR	BANANA DAIRY BAR
BLUEBERRY DESSERT BAR	CHOC CHIP DESSERT	APPLE CINN DESSERT	PECAN DESSERT BAR	CHOC HALVA DESSERT	BRAN DESSERT
SHREDDED WHEAT BAR	WHEATIES BAR	BRAN FLAKE BAR	LIFE CEREAL BAR	GRAPENUT CEREAL BAR	CORN FLAKE BAR
TROPICAL PUNCH BEV BAR	LEMONADE BEV BAR	ORANGE BEV BAR	LEMON LIME BEV BAR	STRAWBERRY BEV BAR	RASPBERRY BEV BAR
COCOA BEV BAR	COCOA BEV BAR	COCOA BEV BAR	COCOA BEV BAR	COCOA BEV BAR	COCOA BEV BAR
BEEF JERKY	BEEF JERKY	BEEF JERKY	BEEF JERKY	BEEF JERKY	BEEF JERKY

MENU SUMMARY

MENU	WATER (g)	PRO (g)	FAT (g)	ASH (g)	CALCIUM (mg)	PHOSPH (mg)	IRON (mg)	SODIUM (mg)	POTASSIUM (mg)	MG (mg)	NACL (g)
MENU 1	21.5	85.3	115.5	16.1	1071.6	1513.5	25.0	3249.3	3931.7	608.5	7.5
MENU 2	19.6	71.4	112.3	17.7	1073.7	1219.4	26.0	3228.8	3827.6	574.9	7.3
MENU 3	20.4	70.5	116.0	16.4	1015.7	1308.5	27.8	3317.5	3574.7	562.3	7.3
MENU 4	19.0	75.0	113.9	15.5	1209.9	1354.7	29.5	3209.1	3721.1	567.3	7.1
MENU 5	21.6	79.1	110.4	18.0	1046.6	1412.5	27.3	3676.0	4255.1	629.5	7.3
MENU 6	20.1	73.8	117.3	16.6	1392.4	1262.8	24.8	3281.4	4013.6	300.0	7.7
MEAN	20.4	75.9	114.2	16.7	1135.0	1345.2	26.7	3327.0	3887.3	540.4	7.4

MENU	A (IU)	CAROTENE (mg)	TOTAL A (IU)	C (mg)	B1 (mg)	B2 (mg)	NIACIN (mg)	B6 (mg)	CHO (g)	KCAL	WT. (g)
MENU 1	2211.8	439.2	2651.0	135.7	1.9	2.9	40.3	3.0	183.8	2116.1	422.2
MENU 2	3687.6	2723.6	6411.2	161.6	2.1	3.1	32.2	3.6	191.6	2062.8	412.5
MENU 3	5094.5	74.0	5168.5	124.7	2.9	3.3	36.3	4.9	197.8	2116.8	421.0
MENU 4	3043.6	0.0	3043.6	123.6	2.8	3.2	38.0	2.8	197.0	2078.2	420.4
MENU 5	4238.2	762.9	5001.1	119.6	2.2	3.2	37.6	5.1	215.4	2172.0	444.5
MENU 6	3934.6	844.5	4779.1	134.4	2.7	3.7	39.2	5.3	199.6	2127.9	427.4

RATION LIGHTWEIGHT-30 DAYS
11 MAY 1988

MENU 1

FOOD ITEM	WATER (g)	PRO (g)	FAT (g)	ASH (g)	CALCIUM (mg)	PHOSPH (mg)	IRON (mg)	SODIUM (mg)	POTASSIUM (mg)	MG (mg)	NACL (g)
CHICKEN A LA KING	1.9	35.4	15.6	4.1	55.8	415.6	1.6	1280.8	681.2	56.7	3.2
NACHO CHEESE BREAD	0.9	5.5	14.1	2.1	122.9	136.6	14.7	441.6	67.1	375.8	0.7
ALMOND DAIRY BAR	0.7	6.4	23.7	1.0	138.0	142.4	0.6	80.3	234.8	45.6	0.2
BLUEBERRY DESSERT BAR	2.5	4.8	17.6	0.9	6.8	78.5	1.3	69.4	75.3	20.1	0.2
SHREDDED WHEAT BAR	2.0	6.5	16.0	1.8	70.2	182.1	0.7	278.5	220.9	40.0	0.7
TROPICAL PUNCH BEV BAR	0.9	0.0	0.8	1.8	606.3	213.9	0.7	10.8	1945.4	4.5	0.0
COCOA BEV BAR	1.2	3.8	23.6	1.2	64.7	138.8	2.6	95.1	284.7	40.1	0.2
BEEF JERKY	11.3	22.8	4.2	3.3	6.9	205.5	2.7	992.9	422.3	25.7	2.3
TOTALS	21.5	85.3	115.5	16.1	1071.6	1513.5	25.0	3249.3	3931.7	608.5	7.5

	A (IU)	CAROTENE (mg)	TOTAL A (IU)	C (mg)	B1 (mg)	B2 (mg)	NIACIN (mg)	B6 (mg)	CHO (g)	KCAL	WT. (g)
CHICKEN A LA KING	0.0	439.2	439.2	0.0	0.1	0.2	16.9	0.1	12.2	330.8	69.2
NACHO CHEESE BREAD	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	19.1	225.3	41.7
ALMOND DAIRY BAR	733.5	0.0	733.5	0.0	0.0	0.3	0.6	0.0	11.6	284.9	43.4
BLUEBERRY DESSERT BAR	0.0	0.0	0.0	0.0	0.2	0.1	1.1	0.1	27.6	288.0	53.4
SHREDDED WHEAT BAR	0.0	0.0	0.0	0.0	0.1	0.1	2.4	0.1	44.8	349.2	71.0
TROPICAL PUNCH BEV BAR	0.0	0.0	0.0	135.7	0.0	0.0	0.1	0.0	50.5	209.0	53.9
COCOA BEV BAR	1478.4	0.0	1478.4	0.0	1.4	1.9	14.4	2.5	16.7	295.3	46.6
BEEF JERKY	0.0	0.0	0.0	0.0	0.0	0.2	4.6	0.1	1.4	134.1	43.0
TOTALS	2211.8	439.2	2651.0	135.7	1.9	2.9	40.3	3.0	183.8	2116.1	422.2

RATION LIGHTWEIGHT-30 DAYS
11 MAY 1988

MENU 2

FOOD ITEM	WATER (g)	PRO (g)	FAT (g)	ASH (g)	CALCIUM (mg)	PHOSPH (mg)	IRON (mg)	SODIUM (mg)	POTASSIUM (mg)	MG (mg)	NACL (g)
BEEF STEW	1.0	23.5	13.1	4.7	36.9	219.3	2.5	835.4	401.9	31.8	2.1
TAMALE BREAD	0.8	5.8	13.4	2.3	143.6	131.5	14.5	596.5	105.5	372.9	0.9
STRAWBERRY DAIRY	0.8	4.8	21.3	0.8	134.1	106.4	0.3	62.0	228.4	17.3	0.2
CHOC CHIP DESSERT	2.0	5.0	21.2	1.1	15.4	1.1	1.5	145.6	154.0	41.9	0.3
WHEATIES BAR	1.6	5.7	14.7	2.3	63.5	183.9	0.9	491.1	210.5	40.1	1.2
LEMONADE BEV BAR	0.9	0.0	0.8	1.8	638.6	232.8	0.8	10.1	2020.3	5.0	0.0
COCOA BEV BAR	1.2	3.8	23.6	1.2	64.7	138.8	2.6	95.1	284.7	40.1	0.2
BEEF JERKY	11.3	22.8	4.2	3.3	6.9	205.5	2.7	992.9	422.3	25.7	2.3
	19.6	71.4	112.3	17.7	1073.7	1219.4	26.0	3228.8	3827.6	574.9	7.3

	A (IU)	CAROTENE (mg)	TOTAL A (IU)	C (mg)	B1 (mg)	B2 (mg)	NIACIN (mg)	B6 (mg)	CHO (g)	KCAL	WT. (g)
BEEF STEW	0.0	2598.5	2598.5	0.0	0.1	0.2	5.1	0.1	20.7	295.1	63.1
TAMALE BREAD	140.2	125.2	265.4	0.0	0.0	0.1	0.4	0.1	18.3	217.0	40.6
STRAWBERRY DAIRY	456.7	0.0	456.7	27.8	0.0	0.2	0.3	0.0	14.2	267.5	41.9
CHOC CHIP DESSERT	0.0	0.0	0.0	0.0	0.1	0.1	1.1	0.1	26.7	317.4	56.0
WHEATIES BAR	1612.3	0.0	1612.3	11.3	0.4	0.5	6.4	0.7	43.1	327.7	67.5
LEMONADE BEV BAR	0.0	0.0	0.0	122.6	0.0	0.0	0.1	0.0	50.5	209.0	53.9
COCOA BEV BAR	1478.4	0.0	1478.4	0.0	1.4	1.9	14.4	2.5	16.7	295.0	46.6
BEEF JERKY	0.0	0.0	0.0	0.0	0.0	0.2	4.6	0.1	1.4	134.1	42.0
	3687.6	2723.6	6411.2	161.6	2.1	3.1	32.2	3.6	191.6	2062.8	412.5

RATION LIGHTWEIGHT-30 DAYS
11 MAY 1988

MENU 3

FOOD ITEM	WATER (g)	PRO (g)	FAT (g)	ASH (g)	CALCIUM (mg)	PHOSPH (mg)	IRON (mg)	SODIUM (mg)	POTASSIUM (mg)	MG (mg)	NACL (g)
PORK & RICE	1.5	22.1	11.4	4.3	32.6	254.7	2.6	1033.8	387.3	36.9	2.6
PIZZA BREAD	0.8	5.5	12.8	2.0	117.4	119.8	16.2	551.9	99.8	375.0	0.7
VANILLA DAIRY BAR	0.5	4.9	25.7	0.8	94.8	89.0	0.2	123.4	136.6	9.9	0.3
APPLE CINN DESSERT	2.3	4.6	20.9	0.6	15.1	74.4	1.2	56.2	87.7	21.8	0.1
BRAN FLAKE BAR	2.0	6.8	16.5	2.5	67.1	197.2	1.5	454.0	211.8	48.5	1.1
ORANGE BEV BAR	0.9	0.0	0.8	1.8	617.0	229.0	0.8	10.3	1944.4	4.5	0.0
COCOA BEV BAR	1.2	3.8	23.6	1.2	64.7	138.8	2.6	95.1	284.7	40.1	0.2
BEEF JERKY	11.3	22.8	4.2	3.3	6.9	205.5	2.7	992.9	422.3	25.7	2.3
	20.4	70.5	116.0	16.4	1015.7	1308.5	27.8	3317.5	3574.7	562.3	7.3

	A (IU)	CAROTENE (mg)	TOTAL A (IU)	C (mg)	B1 (mg)	B2 (mg)	NIACIN (mg)	B6 (mg)	CHO (g)	KCAL	WT. (g)
PORK & RICE	0.0	0.0	0.0	0.0	0.9	0.2	6.5	0.1	31.9	319.1	71.2
PIZZA BREAD	0.0	74.0	74.0	0.0	0.0	0.1	0.5	0.1	18.1	209.5	39.1
VANILLA DAIRY BAR	778.3	0.0	778.3	0.0	0.0	0.1	0.1	0.0	9.5	289.1	41.4
APPLE CINN DESSERT	0.0	0.0	0.0	0.0	0.1	0.1	0.8	0.1	25.1	106.9	53.5
BRAN FLAKE BAR	2837.8	0.0	2837.8	9.9	0.4	0.7	9.8	2.0	44.6	354.1	72.3
ORANGE BEV BAR	0.0	0.0	0.0	114.8	0.0	0.0	0.1	0.0	50.5	209.0	53.9
COCOA BEV BAR	1478.4	0.0	1478.4	0.0	1.4	1.9	14.4	2.5	16.7	295.0	46.6
BEEF JERKY	0.0	0.0	0.0	0.0	0.0	0.2	4.6	0.1	1.4	134.1	43.0
	5094.5	74.0	5168.5	124.7	2.9	3.3	36.8	4.9	197.8	2116.8	421.0

RATION LIGHTWEIGHT-30 DAYS
11 MAY 1988

MENU 4

FOOD ITEM	WATER (g)	PRO (g)	FAT (g)	ASH (g)	CALCIUM (mg)	PHOSPH (mg)	IRON (mg)	SODIUM (mg)	POTASSIUM (mg)	MG (mg)	NACL (g)
CHICKEN AND RICE	0.9	23.8	9.6	3.1	19.5	263.4	2.2	1016.4	365.4	30.0	2.5
BACON CHEESE BREAD	0.8	5.8	15.5	2.0	121.0	140.0	14.3	555.6	75.2	378.8	0.7
DR-PINE-COCO DAIRY	0.8	6.4	24.9	0.9	122.9	109.8	0.5	64.8	236.3	23.1	0.2
PECAN DESSERT BAR	1.3	5.1	21.9	1.1	24.0	56.9	1.2	133.9	116.0	25.7	0.3
LIFE CEREAL BAR	1.7	7.3	13.4	2.2	158.4	186.4	5.0	339.8	243.5	37.6	0.8
LEMON LIME BEV BAR	0.9	0.0	0.8	1.8	692.5	253.8	1.0	10.7	1977.8	6.3	0.0
COCOA BEV BAR	1.2	3.8	23.6	1.2	64.7	138.8	2.6	95.1	284.7	40.1	0.2
BEEF JERKY	11.3	22.8	4.2	3.3	6.9	205.5	2.7	992.9	422.3	25.7	2.3
	19.0	75.0	113.9	15.5	1209.9	1354.7	29.5	3209.1	3721.1	567.3	7.1

	A (IU)	CAROTENE (mg)	TOTAL A (IU)	C (mg)	B1 (mg)	B2 (mg)	NIACIN (mg)	B6 (mg)	CHO (g)	KCAL	WT. (g)
CHICKEN AND RICE	0.0	0.0	0.0	0.0	0.4	0.1	10.9	0.1	32.6	312.1	70.0
BACON CHEESE BREAD	151.6	0.0	151.6	0.0	0.1	0.1	0.6	0.0	17.2	231.4	41.3
DR-PINE-COCO DAIRY	580.5	0.0	580.5	0.0	0.0	0.1	0.2	0.0	12.1	263.0	45.0
PECAN DESSERT BAR	306.2	0.0	306.2	0.0	0.3	0.1	1.1	0.0	24.8	317.0	54.2
LIFE CEREAL BAR	526.9	0.0	526.9	0.2	0.6	0.7	6.3	0.0	41.7	316.7	66.4
LEMON LIME BEV BAR	0.0	0.0	0.0	123.4	0.0	0.0	0.1	0.0	50.5	209.0	53.9
COCOA BEV BAR	1478.4	0.0	1478.4	0.0	1.4	1.9	14.4	2.5	16.7	295.0	46.6
BEEF JERKY	0.0	0.0	0.0	0.0	0.0	0.2	4.6	0.1	1.4	134.1	43.0
	3043.6	0.0	3043.6	123.6	2.8	3.2	38.0	2.8	197.0	2078.2	420.4

RATION LIGHTWEIGHT-30 DAYS
11 MAY 1988

MENU 5

FOOD ITEM	WATER (g)	PRO (g)	FAT (g)	ASH (g)	CALCIUM (mg)	PHOSPH (mg)	IRON (mg)	SODIUM (mg)	POTASSIUM (mg)	MG (mg)	NACL (g)
SPAGHETTI	2.9	32.0	9.2	6.4	128.4	385.3	2.0	1342.7	1005.7	73.0	2.5
COCONUT BREAD	0.9	3.7	13.0	1.5	61.7	73.9	14.3	508.1	112.3	357.3	0.5
MIXED NUT DAIRY BAR	0.3	4.8	25.1	0.8	80.4	96.4	0.4	83.6	140.0	22.2	0.2
CHOC HALVA DESSERT	1.6	4.3	16.9	1.1	16.4	105.8	1.7	132.0	122.5	66.3	0.3
GRAPENUT CEREAL BAR	2.6	7.7	17.7	1.9	68.4	177.7	2.8	511.7	196.8	40.8	1.3
STRAWBERRY BEV BAR	0.9	0.0	0.8	1.8	619.7	229.0	0.8	10.0	1970.8	4.2	0.0
COCOA BEV BAR	1.2	3.8	23.6	1.2	64.7	138.8	2.6	95.1	284.7	40.1	0.2
BEEF JERKY	11.3	22.8	4.2	3.3	6.9	205.5	2.7	992.9	422.3	25.7	2.3
	21.6	79.1	110.4	18.0	1046.6	1412.5	27.3	3676.0	4255.1	629.5	7.3

	A (IU)	CAROTENE (mg)	TOTAL A (IU)	C (mg)	B1 (mg)	B2 (mg)	NIACIN (mg)	B6 (mg)	CHO (g)	KCAL	WT. (g)
SPAGHETTI	0.0	762.9	762.9	0.0	0.1	0.3	8.2	0.4	36.0	354.7	86.4
COCONUT BREAD	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	17.9	203.1	37.0
MIXED NUT DAIRY BAR	636.0	0.0	636.0	0.0	0.1	0.1	0.2	0.0	9.0	280.9	40.0
CHOC HALVA DESSERT	0.0	0.0	0.0	0.0	0.1	0.1	1.4	0.1	31.9	296.5	55.7
GRAPENUT CEREAL BAR	2123.8	0.0	2123.8	0.0	0.4	0.6	8.4	1.9	52.0	398.7	82.0
STRAWBERRY BEV BAR	0.0	0.0	0.0	119.6	0.0	0.0	0.1	0.0	50.5	209.0	53.9
COCOA BEV BAR	1478.4	0.0	1478.4	0.0	1.4	1.9	14.4	2.5	16.7	295.0	46.6
BEEF JERKY	0.0	0.0	0.0	0.0	0.0	0.2	4.6	0.1	1.4	134.1	43.0
	4238.2	762.9	5001.1	119.6	2.2	3.2	37.6	5.1	215.4	2172.0	444.5

RATION LIGHTWEIGHT-30 DAYS
11 MAY 1988

MENU 6

FOOD ITEM	WATER (g)	PRO (g)	FAT (g)	ASH (g)	CALCIUM (mg)	PHOSPH (mg)	IRON (mg)	SODIUM (mg)	POTASSIUM (mg)	MG (mg)	NACL (g)
CHILI	1.3	28.6	17.3	5.1	86.4	340.8	1.6	1124.9	716.1	56.6	2.8
ORANGE NUT BREAD	0.8	4.4	14.2	1.4	345.4	72.7	15.1	222.3	125.6	125.6	0.4
BANANA DAIRY BAR	0.5	5.2	24.8	0.8	112.8	110.2	0.4	50.9	194.2	24.3	0.2
GRAHAM DESSERT	2.2	3.6	17.9	1.1	85.3	75.5	0.8	258.7	153.7	16.1	0.5
CORN FLAKE BAR	1.9	5.3	14.7	2.0	71.1	88.0	0.7	526.7	146.2	7.4	1.3
RASPBERRY BEV BAR	0.9	0.0	0.8	1.8	619.7	231.2	0.7	9.9	1970.8	4.2	0.0
COCOA BEV BAR	1.2	3.8	23.6	1.2	64.7	138.8	2.6	95.1	284.7	40.1	0.2
BEEF JERKY	11.3	22.8	4.2	3.3	6.9	205.5	2.7	992.9	422.3	25.7	2.3
	20.1	73.8	117.3	16.6	1392.4	1262.8	24.8	3281.4	4013.6	300.0	7.7

	A (IU)	CAROTENE (mg)	TOTAL A (IU)	C (mg)	B1 (mg)	B2 (mg)	NIACIN (mg)	B6 (mg)	CHO (g)	KCAL	WT. (g)
CHILI	0.0	844.5	844.5	0.0	0.1	0.3	7.3	0.3	24.6	368.1	76.8
ORANGE NUT BREAD	0.0	0.0	0.0	0.0	0.1	0.1	1.0	0.0	20.0	224.8	40.6
BANANA DAIRY BAR	446.0	0.0	446.0	23.9	0.0	0.1	0.3	0.0	11.2	266.8	42.4
GRAHAM DESSERT	437.1	0.0	437.1	0.0	0.0	0.2	0.9	0.0	29.9	295.4	54.7
CORN FLAKE BAR	1573.1	0.0	1573.1	0.0	0.9	1.0	10.8	2.3	45.4	334.8	69.3
RASPBERRY BEV BAR	0.0	0.0	0.0	110.5	0.0	0.0	0.1	0.0	50.5	209.0	53.9
COCOA BEV BAR	1478.4	0.0	1478.4	0.0	1.4	1.9	14.4	2.5	16.7	295.0	46.6
BEEF JERKY	0.0	0.0	0.0	0.0	0.0	0.2	4.6	0.1	1.4	134.1	43.0
	3934.6	844.5	4779.1	134.4	2.7	3.7	39.2	5.3	199.6	2127.9	427.4

APPENDIX II

SCHEDULE

DATE/TIME	SUBJECT
T-01 Mon	18 Jan 88
0600-0700	Morning Meal
0700-0800	Formation/Draw Weapons
0800-0900	Move to Grouse Meadows
0900-1000	10 Man Tent Bivouac Routine Demo
1000-1200	Establish Bivouac
1200-1300	Noon Meal
1300-1400	Track Discipline/Track Plan Demo
1400-1600	Ski Sequence w/Equipment
1600-1800	Bivouac Routine
1800-1830	Light & Noise Discipline
1830-2000	5 Km Snowshoe March
T-02 Tues	19 Jan 88
0600-0700	Morning Meal
0700-0730	Strike Bivouac Demo
0730-0800	Strike Bivouac
0800-0900	Displacement
0900-1000	Establish Bivouac
1000-1200	Ski Sequence w/Equipment
1200-1300	Noon Meal
1300-1400	Norwegian Tent Sheet Demo
1400-1430	Strike Tents & Stage Ahkios
1430-1600	Establish Bivouac w/Tent Sheets
1600-1700	Arctic Sentry Routine
1700-2100	Bivouac Routine (Tactical)
2100-2130	Issue Night Displacement Order
2130-2230	Bivouac Routine (Tactical)
2230-0200	Night Displacement/Establish New Bivouac
T-03 Wed	20 Jan 88
0700-0800	Morning Meal
0800-0845	Defensive Positions
0845-0915	Survival Snow Shelters & Fires
0915-0945	Camouflage, Cover & Concealment
0945-1030	Tactical Mvmt & Trailbreaking
1030-1300	Battle Drill/Skijoring
1300-1400	Noon Meal
1400-1630	Skijoring/Battle Drill
1630-1700	Issue Night Displacement Order
1700-1800	Evening Meal
1800-2100	Bivouac Routine (Tactical)
2100-2300	Night Displacement/Est New Bivouac (Tactical)

SCHEDULE

DATE/TIME	SUBJECT
T-04 Thurs	21 Jan 88
0800-0830	Displacement to New Bivouac
0830-1000	Establish Bivouac
1000-1030	Mtn Casualty Evacuation
1030-1200	Arctic Navigation
1200-1300	Noon Meal/Prep for Ski Race
1300-1500	6Km ski Race
1500-1700	Squad Instructor's Time
1700-1800	Evening Meal
1800-1900	Bivouac Routine
1900-2200	Night Land Navigation Exercise
T-05 Fri	22 Jan 88
0700-0800	Morning Meal
0800-0815	Strike Bivouac
0815-1100	Ski Mvmt to UBC
1100-1300	Noon Meal
1300-1400	Ski Tuning Demo
1400-1600	Squad Instructor's Time
1600-1630	Weapons Cleaning
1630-1700	Weapons Turn-in
1700-1800	Evening Meal
T-06/07 Sat/Sun	23-24 Jan 88
	Holiday Routine
T-08 Mon	25 Jan 88
0630-0730	Morning Meal
0730-0800	Formation/Draw Weapons
0800-0830	Post Test #3
0830-0900	Move to Airfield
0900-1000	Enplanning/Deplanning Drills
1000-1100	Airlift to Upper Sardine Meadows
1100-1400	Ski March to Lower Sardine Meadows
1400-1500	Establish Bivouac
1500-2400	Bivouac Routine
T-09 Tues	26 Jan 88
0700-0800	Morning Meal
0800-1000	Ski Sequence Teachbacks
1000-1100	Arctic Patrolling
1100-1200	Occupation of a Patrol Base (Demo)
1200-1300	Noon Meal

SCHEDULE

DATE/TIME	SUBJECT
T-09 Tues	26 Jan 88 (Continued)
1300-1400	Issue Order for Exercise "Lightfoot"
1400-1530	Establish Patrol Base
1530-1700	Patrol Prep Time
1700-1800	Evening Meal
1800-2400	Exercise "Lightfoot"
T-10 Wed	27 Jan 88
0001-006	Exercise "Lightfoot"
0600-1200	Squad Instructor's Time
1200-1300	Debrief Exercise "lightfoof"
1300-1700	Ski Sequence
1700-2400	Bivouac Routine
T-11 Thurs	28 Jan 88
0630-0730	Morning Meal
0730-0800	Frag Order for Plt in the Attack
0800-0830	Strike Bivouac
0830-0900	Move to Assembly Area
0900-0930	Prep for Attack
0930-1000	Cross LOD/Conduct Assault
1000-1030	Debrief Plt Attack
1030-1200	Noon Meal/Prep for Biathalon
1200-1400	10Km Ski Biathalon
1400-1430	Recovery
1430-1500	Prepare HLZ
1500-1600	Airlift to MWTC
1600-1630	Weapons Cleaning
1630-1700	Weapons Turn-in
1700-1800	Evening Meal
T-12 Fri	29 Jan 88
0700-0800	Morning Meal
0800-0900	Specific Snow & Ice Equipment
0900-1100	Issue Snow & Ice Equip/Adjust Crampons
1100-1200	Advanced Avalanches
1200-1300	Noon Meal
1300-1400	Glaciology
1400-1700	Squad Instructor's Time

APPENDIX III

Name _____ **Test Subject Number** _____

This is your log book to record the quantity of food and water you consume each day for one week. These log books will be collected and new log books issued at the end of the first 5 test days. While the recording of this data may be tedious and repetitious to you, it is very important that you be as thorough and complete as possible, because this data will be used to calculate whether or not you received adequate nutrition (recommended dietary allowances) each day. You must fill these pages out daily. A quick entry after each meal will help you avoid forgetting to mark down food items or fluids consumed. Also, keeping track of urinations and defications with pencil slashes and then adding up totals, and circling the appropriate number for each at the end of the day will help you to keep an accurate account.

We are also interested in improving the quality of this ration. Your ratings and comments will help us make better rations for you. Thank you for your cooperation.

DAY 1

MRE RATION CONSUMPTION
Please circle the amount that indicates how much of each item you ate today. If the appropriate number is not listed, write it on the line provided. For example: If you eat 2 beef stew entrees, circle 2. If you drink 2 1/2 canteen cups of coffee, write in "2 1/2".

ADDED WATER
Please list the amount of water you added to each food or beverage item consumed. Write in "0" if you did not add water to an item that you consumed.

FOOD ITEM	CODE	AMOUNT CONSUMED (by package)					WATER(in canteen cups) i.e., 1/4, 1/2, 3/4, etc.
ENTREES							
PORK W/RICE/BBQ SAUCE	114	1/4	1/2	3/4	1	2	____ _____
CORNED BEEF HASH	112	1/4	1/2	3/4	1	2	____ _____
CHICKEN STEW	110	1/4	1/2	3/4	1	2	____ _____
HAM OMELET	106	1/4	1/2	3/4	1	2	____ _____
SPAGHETTI W/MEAT SCE	107	1/4	1/2	3/4	1	2	____ _____
CHICKEN A LA KING	176	1/4	1/2	3/4	1	2	____ _____
BEEF STEW	113	1/4	1/2	3/4	1	2	____ _____
HAM SLICE	105	1/4	1/2	3/4	1	2	____ _____
MEATBALLS W/RICE	109	1/4	1/2	3/4	1	2	____ _____
TUNA W/NOODLES	111	1/4	1/2	3/4	1	2	____ _____
CHICKEN W/RICE	104	1/4	1/2	3/4	1	2	____ _____
HAM CHUNKS W/ESC POT	108	1/4	1/2	3/4	1	2	____ _____
STARCH							
CRACKERS	117	1/4	1/2	3/4	1	2	____ _____
POTATO AU GRATIN	178	1/4	1/2	3/4	1	2	____ _____
SPREAD							
CHEESE	103	1/4	1/2	3/4	1	2	____ _____
JELLY	131	1/4	1/2	3/4	1	2	____ _____
PEANUT BUTTER	116	1/4	1/2	3/4	1	2	____ _____
FRUIT							
APPLESAUCE	124	1/4	1/2	3/4	1	2	____ _____
FRUIT MIX	125	1/4	1/2	3/4	1	2	____ _____
PEACHES	126	1/4	1/2	3/4	1	2	____ _____
STRAWBERRIES	127	1/4	1/2	3/4	1	2	____ _____
PEARS	192	1/4	1/2	3/4	1	2	____ _____
DESSERT							
CHOC CVD BROWNIE	122	1/4	1/2	3/4	1	2	____ _____
CHERRY NUT CAKE	118	1/4	1/2	3/4	1	2	____ _____
CHOC CVD COOKIE BAR	123	1/4	1/2	3/4	1	2	____ _____
CHOCOLATE NUT CAKE	120	1/4	1/2	3/4	1	2	____ _____
MAPLE NUT CAKE	119	1/4	1/2	3/4	1	2	____ _____
OATMEAL COOKIE BAR	121	1/4	1/2	3/4	1	2	____ _____
BEVERAGE							
BEVERAGE BASE PWD	177	1/4	1/2	3/4	1	2	____ _____
COCOA POWDER	129	1/4	1/2	3/4	1	2	____ _____
COFFEE	137	1/4	1/2	3/4	1	2	____ _____
CREAM SUBSTITUTE	102	1/4	1/2	3/4	1	2	____ _____
SUGAR	138	1/4	1/2	3/4	1	2	____ _____
OTHER							
TABASCO	128	1/4	1/2	3/4	1	2	____ _____
TOOTSIE ROLL	190	1/4	1/2	3/4	1	2	____ _____
CHARMS	191	1/4	1/2	3/4	1	2	____ _____
GUM	182	1/4	1/2	3/4	1	2	____ _____
SALT	179	1/4	1/2	3/4	1	2	____ _____

PLEASE COMPLETE AFTER EATING DINNER: If +100 is the fullest that you can imagine, and -100 is the hungriest, how full or hungry are you now?

DAY 1

RATION COLD WEATHER CONSUMPTION
Circle the number that indicates how much of each item you ate today. If you ate an amount that is not listed, write it on the line to the right. All food items issued or traded for today should be fully accounted for in the colums listed below as "AMOUNT CONSUMED" "DID NOT EAT/FINISH". Remember - each unit of "1" us equal to the total content of each food item in 1 RCW. For example, 4 bars of Spaghetti & Meat Sauce = 1 unit.

ADDED WATER
Please list the amount of water you added to each food or beverage item. Write in "0" if you did not add water to a food you ate.

FOOD ITEM	CODE	AMOUNT CONSUMED					WATER (IN CANTEEN CUPS ie; 1/4,1/2,etc.
ENTREES							
OATMEAL (APPLE & CINN)	212	1/4	1/2	3/4	1	___	_____
OATMEAL (MAPLE & BRN SGR)	213	1/4	1/2	3/4	1	___	_____
OATMEAL (STRAWBERRY)	214	1/4	1/2	3/4	1	___	_____
CHICKEN STEW	203	1/4	1/2	3/4	1	___	_____
BEEF & VEGETABLE	204	1/4	1/2	3/4	1	___	_____
PORK & ESC. POTATO	205	1/4	1/2	3/4	1	___	_____
CHICKEN ALA KING	206	1/4	1/2	3/4	1	___	_____
SPAGHETTI W/MEAT SAUCE	208	1/4	1/2	3/4	1	___	_____
CHICKEN & RICE	207	1/4	1/2	3/4	1	___	_____
DRINKS/SOUPS							
LEMON TEA	223	1/4	1/2	3/4	1	___	_____
ORANGE BEVERAGE	222	1/4	1/2	3/4	1	___	_____
CHICKEN SOUP	210	1/4	1/2	3/4	1	___	_____
FRUIT SOUP STRAWBERRY	227	1/4	1/2	3/4	1	___	_____
FRUIT SOUP RASPBERRY	228	1/4	1/2	3/4	1	___	_____
COCOA	201	1/4	1/2	3/4	1	___	_____
COFFEE	224	1/4	1/2	3/4	1	___	_____
CREAM	202	1/4	1/2	3/4	1	___	_____
SUGAR	225	1/4	1/2	3/4	1	___	_____
SNACKS							
COOKIES, CHOC.COV.	217	1/4	1/2	3/4	1	___	_____
BROWNIE	219	1/4	1/2	3/4	1	___	_____
RAISINUT CRUNCH	211	1/4	1/2	3/4	1	___	_____
GRANOLA	215	1/4	1/2	3/4	1	___	_____
OATMEAL COOKIE	216	1/4	1/2	3/4	1	___	_____
CHOCOLATE	226	1/4	1/2	3/4	1	___	_____
BLUEBERRY	218	1/4	1/2	3/4	1	___	_____
FIG	220	1/4	1/2	3/4	1	___	_____
CHEWING GUM	275	1/4	1/2	3/4	1	___	_____

DAY 1

LIGHT WEIGHT RATION CONSUMPTION
Circle the number that indicates how much of each item you ate today. If you ate an amount that is not listed, write it on the line to the right. All food items issued or traded for today should be fully accounted for in the colums listed below as "AMOUNT CONSUMED" "DID NOT EAT/FINISH".
For ex: If you eat 2 beef stew entrees, circle 2.
If you eat 1/2 of the beef jerky, circle 1/2.
If you use 1 1/2 packages of cocoa, write in "1 1/2"

ADDED WATER
Please list the amount of water you added to each food or beverage item. Write in "0" if you did not add water to a food you ate.

FOOD ITEM	CODE	AMOUNT CONSUMED (BY PACKAGE)						WATER IN CANTEEN CUPS ie. 1/4, 1/2, etc.
CEREAL BARS								
BRAN FLAKES	357	1/4	1/2	3/4	1	2	_____	_____
CORN FLAKES	358	1/4	1/2	3/4	1	2	_____	_____
MALTED WHEAT GRANULES	362	1/4	1/2	3/4	1	2	_____	_____
OAT CEREAL BISCUITS	361	1/4	1/2	3/4	1	2	_____	_____
SHREDDED WHEAT	360	1/4	1/2	3/4	1	2	_____	_____
WHEAT FLAKES	359	1/4	1/2	3/4	1	2	_____	_____
ENTREES								
BEEF STEW	354	1/4	1/2	3/4	1	2	_____	_____
CHICKEN A LA KING	350	1/4	1/2	3/4	1	2	_____	_____
CHICKEN W/RICE AND HAM	356	1/4	1/2	3/4	1	2	_____	_____
CHILI CON CARNE	353	1/4	1/2	3/4	1	2	_____	_____
PORK WITH RICE	351	1/4	1/2	3/4	1	2	_____	_____
SPAGHETTI W/MEAT + SAUCE	355	1/4	1/2	3/4	1	2	_____	_____
BEEF JERKY	352	1/4	1/2	3/4	1	2	_____	_____
BREAD CRISP								
BACON CHEESE	366	1/4	1/2	3/4	1	2	_____	_____
COCONUT	367	1/4	1/2	3/4	1	2	_____	_____
NACHO CHEESE	365	1/4	1/2	3/4	1	2	_____	_____
ORANGE NUT	364	1/4	1/2	3/4	1	2	_____	_____
PIZZA	363	1/4	1/2	3/4	1	2	_____	_____
TAMALE	368	1/4	1/2	3/4	1	2	_____	_____
DAIRY BARS								
ALMOND	349	1/4	1/2	3/4	1	2	_____	_____
BANANA	345	1/4	1/2	3/4	1	2	_____	_____
MIXED NUT	344	1/4	1/2	3/4	1	2	_____	_____
ORANGE PINEAPPLE COCONUT	347	1/4	1/2	3/4	1	2	_____	_____
STRAWBERRY	346	1/4	1/2	3/4	1	2	_____	_____
VANILLA	348	1/4	1/2	3/4	1	2	_____	_____
DESSERTS								
APPLE CINNAMON	369	1/4	1/2	3/4	1	2	_____	_____
BLUEBERRY	374	1/4	1/2	3/4	1	2	_____	_____
CHOCOLATE CHIP	370	1/4	1/2	3/4	1	2	_____	_____
CHOCOLATE HALVA	371	1/4	1/2	3/4	1	2	_____	_____
GRAHAM	373	1/4	1/2	3/4	1	2	_____	_____
PECAN	372	1/4	1/2	3/4	1	2	_____	_____
DRINKS								
COCOA	339	1/4	1/2	3/4	1	2	_____	_____
COFFEE	390	1/4	1/2	3/4	1	2	_____	_____
CREAM SUBSTITUTE	391	1/4	1/2	3/4	1	2	_____	_____
LEMONADE BEVERAGE	343	1/4	1/2	3/4	1	2	_____	_____
ORANGE BEVERAGE	341	1/4	1/2	3/4	1	2	_____	_____
RASPBERRY BEVERAGE	384	1/4	1/2	3/4	1	2	_____	_____
STRAWBERRY BEVERAGE	340	1/4	1/2	3/4	1	2	_____	_____
TROPICAL PUNCH BEVERAGE	342	1/4	1/2	3/4	1	2	_____	_____
LEMON-LIME BEVERAGE	383	1/4	1/2	3/4	1	2	_____	_____
TEA	385	1/4	1/2	3/4	1	2	_____	_____
OTHER								
GUM	392	1/4	1/2	3/4	1	2	_____	_____
HOT SAUCE	393	1/4	1/2	3/4	1	2	_____	_____

PLEASE COMPLETE AFTER EATING DINNER IF +100 IS THE FULLEST YOU CAN IMAGINE, AND -100 IS THE HUNGRIEST, HOW FULL OR HUNGRY ARE YOU NOW?

APPENDIX IV

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 40-38; the proponent agency is the Office of the Surgeon General

THIS FORM IS AFFECTED BY THE PRIVACY ACT OF 1974

1. AUTHORITY: 10 USC 3012, 44 USC 3101 and 10 USC 1071-1087.

2. PRINCIPAL PURPOSE: To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purposes.

3. ROUTINE USES: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study; implementation of medical programs; teaching; adjudication of claims; and for the mandatory reporting of medical condition as required by law. Information may be furnished to Federal, State and local agencies.

4. MANDATORY OR VOLUNTARY DISCLOSURE: The furnishing of SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this investigational study.

PART A - VOLUNTEER AFFIDAVIT

VOLUNTEER SUBJECTS IN APPROVED DEPARTMENT OF THE ARMY RESEARCH STUDIES

Volunteers under the provisions of AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies.

I, _____ SSN _____ having
(last, first, middle)

full capacity to consent and having attained my _____ birthday, do hereby volunteer to participate in

A Comparison of Three Ration Systems During a High Altitude Cold Weather Field Training Exercise
(research study)

under direction of Reed W. Hoyt, Ph.D. conducted at USARIEM, Natick, MA
(name of institution)

The implications of my voluntary participation; the nature, duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

Dr. Reed W. Hoyt (617) 651-4802

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights on study-related injury I may contact

Office of Chief Counsel

at Natick Research, Development and Engineering Center (617) 651-4322
(name and address of hospital & phone number (include area code))

I understand that I may at any time during the course of this study revoke my consent and withdraw from the study without further penalty or loss of benefits however, I may be ☐ required *(military volunteer)* or ☐ requested *(civilian volunteer)* to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

PART B - TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: (Provide a detailed explanation in accordance with Appendix E, AR 40-38 or AR 70-25.)

See attached.

(CONTINUE ON REVERSE)

PART B - TO BE COMPLETED BY INVESTIGATOR *(contd)*

VOLUNTEER AGREEMENT STATEMENT

Description

We are requesting your participation in a 15 day research study on ration consumption and energy expenditure during the field training exercises of the Mountain Leader Training Course at the Marine Corps Mountain Warfare Training Center (MCMWTC), Bridgeport, California. The purpose of this study is to evaluate and the Ration, Cold Weather (RCW), the Ration, Light Weight (RLW), and the Meal, Ready-to-Eat (MRE VIII), as the sole sources of food for Marines for 12 consecutive days. You will be required to eat one type of these field rations for 12 consecutive days including a weekend. You will also be asked to drink only the water provided by the research team for the duration of the experiment.

Measurements will be taken at weekly intervals during the test. You will also be asked to complete questionnaires in the field which provide information on your food and water consumption, and your mood and physical state. These tests will take little of your time and should be a minor inconvenience but will provide important information needed to evaluate the rations and to determine the amount of energy you take in as food. Other questionnaires you will be asked to fill out at the end of the test will provide the ration developers with information needed to improve the taste, packaging and ease of use of the rations. A logbook (pocket sized) will be issued to you each week to record your daily food and water intakes. You will be asked to collect small samples of your urine while you are in the field. The concentration of these urine samples will indicate whether your water consumption is adequate. Your urine will be analyzed for specific gravity (concentration), and for modified water concentrations.

We wish to measure the volume of water in your body and the rate at which you expend energy. We will do this by having you drink modified water that contains a non-radioactive substance. The modified water you will drink is safe. We will allow time for the modified water you drink to mix with your body water (3 to 4 hours) and then we will collect samples of saliva and urine for chemical analysis. Total body water will be calculated by measuring the dilution of the modified water in your saliva and urine. Additional saliva (teaspoons) and urine samples (teaspoons) will be collected and used to determine energy expenditure from the rate of excretion of modified water from your body.

We also wish to record your activity during exercise in the field. The device for measuring your level of activity consists of a small battery-powered device which is simply strapped to your wrist. There is no risk of electrical shock.

Venous blood samples will be collected four times during the experiment. Blood samples will be collected with a small sterile needle from an arm vein by skilled personnel. These procedures involve very little risk of injury beyond the possibility of bruising and temporary discomfort. This procedure is no different than having blood taken in the doctor's office or in a hospital clinic. The total amount of blood withdrawn over the course of the study will be less than a pint. These blood samples will help us to monitor the state of your metabolism.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN *(If volunteer is a minor)*
PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS	DATE SIGNED

Reverse of DA FORM 5303-R, Apr 84

PART B - TO BE COMPLETED BY INVESTIGATOR *(contd)*

You will take either a stationary bicycle stress test or a treadmill stress test Either test provides an accurate measure of your physical fitness. The bicycle stress test requires that you pedal on a stationary bicycle to the utmost of your ability. We will start you at a low resistance, but will increase the resistance slightly every minute until you cannot pedal anymore. The treadmill stress test requires that you run to the utmost of your ability. You will start at a level grade, but the slope (grade) will increase every one and one-half minutes until you cannot run anymore. Either test will take about 20 minutes. A stress test will be done on two occasions two weeks apart. Both tests involves breathing through a rubber mouthpiece and wearing a nose clip so that we can measure how much oxygen you use and how fast and deep you are breathing. During these tests you will wear chest electrodes so that we can record your heart rate and rhythm.

Risks and Benefits

The risks of participating in this study are those associated with physical exercise and having venous blood drawn. There are no known risks associated with the ingestion of modified water containing a safe, naturally occurring substance, or with the use of the activity monitor. Although heart problems are uncommon in healthy young adults, the stress of maximal exercise increases the potential for uncovering pre-existing heart problems. Therefore, your heart rhythm will be constantly monitored for any potential heart problems during bouts of maximal exercise. Muscle soreness, cramps, nausea and general fatigue and discomfort may be associated with exercise but are not considered harmful.

Skilled personnel will use sterile techniques to perform the needle puncture of veins in the extremities. There may be some discomfort associated with the skin puncture when venous blood is drawn. There is a chance that an infection or bruise may develop a the site of the puncture, but the risk is small. Accidental bodily injury can result from falling on the treadmill. You will be supervised during bouts of maximal exercise on either the stationary bicycle or the treadmill to minimize any possibility of injury. A Medical Monitor (physician) will oversee all of the testing for your health and safety.

This study is voluntary and you may withdraw at any time without penalty or loss of benefits to which you would otherwise be entitled. You will receive a copy of this consent form, and you may ask as many questions as you like. You will receive no direct benefits from your participation in this study other than the knowledge and experience you may gain from the medical examination and study procedures. The potential benefits to you result from participating in this study are as follows: You will have the personal satisfaction of knowing that you have made an important contribution to the fielding of the Ration, Light Weight, and the Ration, Cold Weather. These rations may help you complete your mission. Your data, comments and suggestions will be carefully evaluated and may lead to beneficial changes in the design and/or content of these rations. The data gathered in this study may be published in a scientific journal and contribute to our understanding of the physiology of man during exercise at high altitude in cold weather, and in response to sleep deprivation.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN *(If volunteer is a minor)*
PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS	DATE SIGNED

Reverse of DA FORM 5303-R, Apr 84

PART B - TO BE COMPLETED BY INVESTIGATOR *(contd)*

If you have any questions concerning this study or your results, you may contact Dr. Reed W. Hoyt, U.S. Army Research Institute of Environmental Medicine, Natick, MA 01760-5007, telephone number (617) 651-4802. All data and medical information obtained about you as an individual will be considered priviledged and held in confidence. Complete confidentiality can not be promised, particularly to subjects who are military members, because information bearing on your health may be required to be reported to appropriate medical or Command authorities, and applicable regulations note the possibility that the Food and Drug Administration and USAMRDC officials may inspect the records.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN *(If volunteer is a minor)*
PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS	DATE SIGNED

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SCHEDULE

DATE/TIME	SUBJECT
T-09 Tues	26 Jan 88 (Continued)
1300-1400	Issue Order for Exercise "Lightfoot"
1400-1530	Establish Patrol Base
1530-1700	Patrol Prep Time
1700-1800	Evening Meal
1800-2400	Exercise "Lightfoot"
T-10 Wed	27 Jan 88
0001-006	Exercise "Lightfoot"
0600-1200	Squad Instructor's Time
1200-1300	Debrief Exercise "lightfoof"
1300-1700	Ski Sequence
1700-2400	Bivouac Routine
T-11 Thurs	28 Jan 88
0630-0730	Morning Meal
0730-0800	Frag Order for Plt in the Attack
0800-0830	Strike Bivouac
0830-0900	Move to Assembly Area
0900-0930	Prep for Attack
0930-1000	Cross LOD/Conduct Assault
1000-1030	Debrief Plt Attack
1030-1200	Noon Meal/Prep for Biathalon
1200-1400	10Km Ski Biathalon
1400-1430	Recovery
1430-1500	Prepare HLZ
1500-1600	Airlift to MWTC
1600-1630	Weapons Cleaning
1630-1700	Weapons Turn-in
1700-1800	Evening Meal
T-12 Fri	29 Jan 88
0700-0800	Morning Meal
0800-0900	Specific Snow & Ice Equipment
0900-1100	Issue Snow & Ice Equip/Adjust Crampons
1100-1200	Advanced Avalanches
1200-1300	Noon Meal
1300-1400	Glaciology
1400-1700	Squad Instructor's Time

APPENDIX III

Name _____ **Test Subject Number** _____

This is your log book to record the quantity of food and water you consume each day for one week. These log books will be collected and new log books issued at the end of the first 5 test days. While the recording of this data may be tedious and repetitious to you, it is very important that you be as thorough and complete as possible, because this data will be used to calculate whether or not you received adequate nutrition (recommended dietary allowances) each day. You must fill these pages out daily. A quick entry after each meal will help you avoid forgetting to mark down food items or fluids consumed. Also, keeping track of urinations and defications with pencil slashes and then adding up totals, and circling the appropriate number for each at the end of the day will help you to keep an accurate account.

We are also interested in improving the quality of this ration. Your ratings and comments will help us make better rations for you. Thank you for your cooperation.

DAY 1

MRE RATION CONSUMPTION
Please circle the amount that indicates how much of each item you ate today. If the appropriate number is not listed, write it on the line provided. For example: If you eat 2 beef stew entrees, circle 2. If you drink 2 1/2 canteen cups of coffee, write in "2 1/2".

ADDED WATER
Please list the amount of water you added to each food or beverage item consumed. Write in "0" if you did not add water to an item that you consumed.

FOOD ITEM	CODE	AMOUNT CONSUMED (by package)					WATER(in canteen cups) i.e., 1/4, 1/2, 3/4, etc.
ENTREES							
PORK W/RICE/BBQ SAUCE	114	1/4	1/2	3/4	1	2	____ _____
CORNED BEEF HASH	112	1/4	1/2	3/4	1	2	____ _____
CHICKEN STEW	110	1/4	1/2	3/4	1	2	____ _____
HAM OMELET	106	1/4	1/2	3/4	1	2	____ _____
SPAGHETTI W/MEAT SCE	107	1/4	1/2	3/4	1	2	____ _____
CHICKEN A LA KING	176	1/4	1/2	3/4	1	2	____ _____
BEEF STEW	113	1/4	1/2	3/4	1	2	____ _____
HAM SLICE	105	1/4	1/2	3/4	1	2	____ _____
MEATBALLS W/RICE	109	1/4	1/2	3/4	1	2	____ _____
TUNA W/NOODLES	111	1/4	1/2	3/4	1	2	____ _____
CHICKEN W/RICE	104	1/4	1/2	3/4	1	2	____ _____
HAM CHUNKS W/ESC POT	108	1/4	1/2	3/4	1	2	____ _____
STARCH							
CRACKERS	117	1/4	1/2	3/4	1	2	____ _____
POTATO AU GRATIN	178	1/4	1/2	3/4	1	2	____ _____
SPREAD							
CHEESE	103	1/4	1/2	3/4	1	2	____ _____
JELLY	131	1/4	1/2	3/4	1	2	____ _____
PEANUT BUTTER	116	1/4	1/2	3/4	1	2	____ _____
FRUIT							
APPLESAUCE	124	1/4	1/2	3/4	1	2	____ _____
FRUIT MIX	125	1/4	1/2	3/4	1	2	____ _____
PEACHES	126	1/4	1/2	3/4	1	2	____ _____
STRAWBERRIES	127	1/4	1/2	3/4	1	2	____ _____
PEARS	192	1/4	1/2	3/4	1	2	____ _____
DESSERT							
CHOC CVD BROWNIE	122	1/4	1/2	3/4	1	2	____ _____
CHERRY NUT CAKE	118	1/4	1/2	3/4	1	2	____ _____
CHOC CVD COOKIE BAR	123	1/4	1/2	3/4	1	2	____ _____
CHOCOLATE NUT CAKE	120	1/4	1/2	3/4	1	2	____ _____
MAPLE NUT CAKE	119	1/4	1/2	3/4	1	2	____ _____
OATMEAL COOKIE BAR	121	1/4	1/2	3/4	1	2	____ _____
BEVERAGE							
BEVERAGE BASE PWD	177	1/4	1/2	3/4	1	2	____ _____
COCOA POWDER	129	1/4	1/2	3/4	1	2	____ _____
COFFEE	137	1/4	1/2	3/4	1	2	____ _____
CREAM SUBSTITUTE	102	1/4	1/2	3/4	1	2	____ _____
SUGAR	138	1/4	1/2	3/4	1	2	____ _____
OTHER							
TABASCO	128	1/4	1/2	3/4	1	2	____ _____
TOOTSIE ROLL	190	1/4	1/2	3/4	1	2	____ _____
CHARMS	191	1/4	1/2	3/4	1	2	____ _____
GUM	182	1/4	1/2	3/4	1	2	____ _____
SALT	179	1/4	1/2	3/4	1	2	____ _____

PLEASE COMPLETE AFTER EATING DINNER: If +100 is the fullest that you can imagine, and -100 is the hungriest, how full or hungry are you now?

DAY 1

RATION COLD WEATHER CONSUMPTION
Circle the number that indicates how much of each item you ate today. If you ate an amount that is not listed, write it on the line to the right. All food items issued or traded for today should be fully accounted for in the colums listed below as "AMOUNT CONSUMED" "DID NOT EAT/FINISH". Remember - each unit of "1" us equal to the total content of each food item in 1 RCW. For example, 4 bars of Spaghetti & Meat Sauce = 1 unit.

ADDED WATER
Please list the amount of water you added to each food or beverage item. Write in "0" if you did not add water to a food you ate.

FOOD ITEM	CODE	AMOUNT CONSUMED					WATER (IN CANTEEN CUPS ie; 1/4,1/2,etc.
ENTREES							
OATMEAL (APPLE & CINN)	212	1/4	1/2	3/4	1	___	_____
OATMEAL (MAPLE & BRN SGR)	213	1/4	1/2	3/4	1	___	_____
OATMEAL (STRAWBERRY)	214	1/4	1/2	3/4	1	___	_____
CHICKEN STEW	203	1/4	1/2	3/4	1	___	_____
BEEF & VEGETABLE	204	1/4	1/2	3/4	1	___	_____
PORK & ESC. POTATO	205	1/4	1/2	3/4	1	___	_____
CHICKEN ALA KING	206	1/4	1/2	3/4	1	___	_____
SPAGHETTI W/MEAT SAUCE	208	1/4	1/2	3/4	1	___	_____
CHICKEN & RICE	207	1/4	1/2	3/4	1	___	_____
DRINKS/SOUPS							
LEMON TEA	223	1/4	1/2	3/4	1	___	_____
ORANGE BEVERAGE	222	1/4	1/2	3/4	1	___	_____
CHICKEN SOUP	210	1/4	1/2	3/4	1	___	_____
FRUIT SOUP STRAWBERRY	227	1/4	1/2	3/4	1	___	_____
FRUIT SOUP RASPBERRY	228	1/4	1/2	3/4	1	___	_____
COCOA	201	1/4	1/2	3/4	1	___	_____
COFFEE	224	1/4	1/2	3/4	1	___	_____
CREAM	202	1/4	1/2	3/4	1	___	_____
SUGAR	225	1/4	1/2	3/4	1	___	_____
SNACKS							
COOKIES, CHOC.COV.	217	1/4	1/2	3/4	1	___	_____
BROWNIE	219	1/4	1/2	3/4	1	___	_____
RAISINUT CRUNCH	211	1/4	1/2	3/4	1	___	_____
GRANOLA	215	1/4	1/2	3/4	1	___	_____
OATMEAL COOKIE	216	1/4	1/2	3/4	1	___	_____
CHOCOLATE	226	1/4	1/2	3/4	1	___	_____
BLUEBERRY	218	1/4	1/2	3/4	1	___	_____
FIG	220	1/4	1/2	3/4	1	___	_____
CHEWING GUM	275	1/4	1/2	3/4	1	___	_____

DAY 1

LIGHT WEIGHT RATION CONSUMPTION
Circle the number that indicates how much of each item you ate today. If you ate an amount that is not listed, write it on the line to the right. All food items issued or traded for today should be fully accounted for in the colums listed below as "AMOUNT CONSUMED" "DID NOT EAT/FINISH".
For ex: If you eat 2 beef stew entrees, circle 2.
If you eat 1/2 of the beef jerky, circle 1/2.
If you use 1 1/2 packages of cocoa, write in "1 1/2"

ADDED WATER
Please list the amount of water you added to each food or beverage item. Write in "0" if you did not add water to a food you ate.

FOOD ITEM	CODE	AMOUNT CONSUMED (BY PACKAGE)					WATER IN CANTEEN CUPS ie. 1/4, 1/2, etc.
CEREAL BARS							
BRAN FLAKES	357	1/4	1/2	3/4	1	2	_____
CORN FLAKES	358	1/4	1/2	3/4	1	2	_____
MALTED WHEAT GRANULES	362	1/4	1/2	3/4	1	2	_____
OAT CEREAL BISCUITS	361	1/4	1/2	3/4	1	2	_____
SHREDDED WHEAT	360	1/4	1/2	3/4	1	2	_____
WHEAT FLAKES	359	1/4	1/2	3/4	1	2	_____
ENTREES							
BEEF STEW	354	1/4	1/2	3/4	1	2	_____
CHICKEN A LA KING	350	1/4	1/2	3/4	1	2	_____
CHICKEN W/RICE AND HAM	356	1/4	1/2	3/4	1	2	_____
CHILI CON CARNE	353	1/4	1/2	3/4	1	2	_____
PORK WITH RICE	351	1/4	1/2	3/4	1	2	_____
SPAGHETTI W/MEAT + SAUCE	355	1/4	1/2	3/4	1	2	_____
BEEF JERKY	352	1/4	1/2	3/4	1	2	_____
BREAD CRISP							
BACON CHEESE	366	1/4	1/2	3/4	1	2	_____
COCONUT	367	1/4	1/2	3/4	1	2	_____
NACHO CHEESE	365	1/4	1/2	3/4	1	2	_____
ORANGE NUT	364	1/4	1/2	3/4	1	2	_____
PIZZA	363	1/4	1/2	3/4	1	2	_____
TAMALE	368	1/4	1/2	3/4	1	2	_____
DAIRY BARS							
ALMOND	349	1/4	1/2	3/4	1	2	_____
BANANA	345	1/4	1/2	3/4	1	2	_____
MIXED NUT	344	1/4	1/2	3/4	1	2	_____
ORANGE PINEAPPLE COCONUT	347	1/4	1/2	3/4	1	2	_____
STRAWBERRY	346	1/4	1/2	3/4	1	2	_____
VANILLA	348	1/4	1/2	3/4	1	2	_____
DESSERTS							
APPLE CINNAMON	369	1/4	1/2	3/4	1	2	_____
BLUEBERRY	374	1/4	1/2	3/4	1	2	_____
CHOCOLATE CHIP	370	1/4	1/2	3/4	1	2	_____
CHOCOLATE HALVA	371	1/4	1/2	3/4	1	2	_____
GRAHAM	373	1/4	1/2	3/4	1	2	_____
PECAN	372	1/4	1/2	3/4	1	2	_____
DRINKS							
COCOA	339	1/4	1/2	3/4	1	2	_____
COFFEE	390	1/4	1/2	3/4	1	2	_____
CREAM SUBSTITUTE	391	1/4	1/2	3/4	1	2	_____
LEMONADE BEVERAGE	343	1/4	1/2	3/4	1	2	_____
ORANGE BEVERAGE	341	1/4	1/2	3/4	1	2	_____
RASPBERRY BEVERAGE	384	1/4	1/2	3/4	1	2	_____
STRAWBERRY BEVERAGE	340	1/4	1/2	3/4	1	2	_____
TROPICAL PUNCH BEVERAGE	342	1/4	1/2	3/4	1	2	_____
LEMON-LIME BEVERAGE	383	1/4	1/2	3/4	1	2	_____
TEA	385	1/4	1/2	3/4	1	2	_____
OTHER							
GUM	392	1/4	1/2	3/4	1	2	_____
HOT SAUCE	393	1/4	1/2	3/4	1	2	_____

PLEASE COMPLETE AFTER EATING DINNER IF +100 IS THE FULLEST YOU CAN IMAGINE, AND -100 IS THE HUNGRIEST, HOW FULL OR HUNGRY ARE YOU NOW?

APPENDIX IV

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 40-38; the proponent agency is the Office of the Surgeon General

THIS FORM IS AFFECTED BY THE PRIVACY ACT OF 1974

1. AUTHORITY: 10 USC 3012, 44 USC 3101 and 10 USC 1071-1087.

2. PRINCIPAL PURPOSE: To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purposes.

3. ROUTINE USES: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study; implementation of medical programs; teaching; adjudication of claims; and for the mandatory reporting of medical condition as required by law. Information may be furnished to Federal, State and local agencies.

4. MANDATORY OR VOLUNTARY DISCLOSURE: The furnishing of SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this investigational study.

PART A - VOLUNTEER AFFIDAVIT

VOLUNTEER SUBJECTS IN APPROVED DEPARTMENT OF THE ARMY RESEARCH STUDIES

Volunteers under the provisions of AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies.

I, _____ SSN _____ having
(last, first, middle)

full capacity to consent and having attained my _____ birthday, do hereby volunteer to participate in

A Comparison of Three Ration Systems During a High Altitude Cold Weather Field Training Exercise
(research study)

under direction of Reed W. Hoyt, Ph.D. conducted at USARIEM, Natick, MA
(name of institution)

The implications of my voluntary participation; the nature, duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by Dr. Reed W. Hoyt (617) 651-4802

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights on study-related injury I may contact

Office of Chief Counsel

at Natick Research, Development and Engineering Center (617) 651-4322
(name and address of hospital & phone number (include area code))

I understand that I may at any time during the course of this study revoke my consent and withdraw from the study without further penalty or loss of benefits however, I may be ☐ required *(military volunteer)* or ☐ requested *(civilian volunteer)* to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

PART B - TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: (Provide a detailed explanation in accordance with Appendix E, AR 40-38 or AR 70-25.)

See attached.

(CONTINUE ON REVERSE)

PART B - TO BE COMPLETED BY INVESTIGATOR *(contd)*

VOLUNTEER AGREEMENT STATEMENT

Description

We are requesting your participation in a 15 day research study on ration consumption and energy expenditure during the field training exercises of the Mountain Leader Training Course at the Marine Corps Mountain Warfare Training Center (MCMWTC), Bridgeport, California. The purpose of this study is to evaluate and the Ration, Cold Weather (RCW), the Ration, Light Weight (RLW), and the Meal, Ready-to-Eat (MRE VIII), as the sole sources of food for Marines for 12 consecutive days. You will be required to eat one type of these field rations for 12 consecutive days including a weekend. You will also be asked to drink only the water provided by the research team for the duration of the experiment.

Measurements will be taken at weekly intervals during the test. You will also be asked to complete questionnaires in the field which provide information on your food and water consumption, and your mood and physical state. These tests will take little of your time and should be a minor inconvenience but will provide important information needed to evaluate the rations and to determine the amount of energy you take in as food. Other questionnaires you will be asked to fill out at the end of the test will provide the ration developers with information needed to improve the taste, packaging and ease of use of the rations. A logbook (pocket sized) will be issued to you each week to record your daily food and water intakes. You will be asked to collect small samples of your urine while you are in the field. The concentration of these urine samples will indicate whether your water consumption is adequate. Your urine will be analyzed for specific gravity (concentration), and for modified water concentrations.

We wish to measure the volume of water in your body and the rate at which you expend energy. We will do this by having you drink modified water that contains a non-radioactive substance. The modified water you will drink is safe. We will allow time for the modified water you drink to mix with your body water (3 to 4 hours) and then we will collect samples of saliva and urine for chemical analysis. Total body water will be calculated by measuring the dilution of the modified water in your saliva and urine. Additional saliva (teaspoons) and urine samples (teaspoons) will be collected and used to determine energy expenditure from the rate of excretion of modified water from your body.

We also wish to record your activity during exercise in the field. The device for measuring your level of activity consists of a small battery-powered device which is simply strapped to your wrist. There is no risk of electrical shock.

Venous blood samples will be collected four times during the experiment. Blood samples will be collected with a small sterile needle from an arm vein by skilled personnel. These procedures involve very little risk of injury beyond the possibility of bruising and temporary discomfort. This procedure is no different than having blood taken in the doctor's office or in a hospital clinic. The total amount of blood withdrawn over the course of the study will be less than a pint. These blood samples will help us to monitor the state of your metabolism.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN *(If volunteer is a minor)*

PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS	DATE SIGNED

Reverse of DA FORM 5303-R, Apr 84

PART B - TO BE COMPLETED BY INVESTIGATOR (contd)

You will take either a stationary bicycle stress test or a treadmill stress test Either test provides an accurate measure of your physical fitness. The bicycle stress test requires that you pedal on a stationary bicycle to the utmost of your ability. We will start you at a low resistance, but will increase the resistance slightly every minute until you cannot pedal anymore. The treadmill stress test requires that you run to the utmost of your ability. You will start at a level grade, but the slope (grade) will increase every one and one-half minutes until you cannot run anymore. Either test will take about 20 minutes. A stress test will be done on two occasions two weeks apart. Both tests involves breathing through a rubber mouthpiece and wearing a nose clip so that we can measure how much oxygen you use and how fast and deep you are breathing. During these tests you will wear chest electrodes so that we can record your heart rate and rhythm.

Risks and Benefits

The risks of participating in this study are those associated with physical exercise and having venous blood drawn. There are no known risks associated with the ingestion of modified water containing a safe, naturally occurring substance, or with the use of the activity monitor. Although heart problems are uncommon in healthy young adults, the stress of maximal exercise increases the potential for uncovering pre-existing heart problems. Therefore, your heart rhythm will be constantly monitored for any potential heart problems during bouts of maximal exercise. Muscle soreness, cramps, nausea and general fatigue and discomfort may be associated with exercise but are not considered harmful.

Skilled personnel will use sterile techniques to perform the needle puncture of veins in the extremities. There may be some discomfort associated with the skin puncture when venous blood is drawn. There is a chance that an infection or bruise may develop a the site of the puncture, but the risk is small. Accidental bodily injury can result from falling on the treadmill. You will be supervised during bouts of maximal exercise on either the stationary bicycle or the treadmill to minimize any possibility of injury. A Medical Monitor (physician) will oversee all of the testing for your health and safety.

This study is voluntary and you may withdraw at any time without penalty or loss of benefits to which you would otherwise be entitled. You will receive a copy of this consent form, and you may ask as many questions as you like. You will receive no direct benefits from your participation in this study other than the knowledge and experience you may gain from the medical examination and study procedures. The potential benefits to you result from participating in this study are as follows: You will have the personal satisfaction of knowing that you have made an important contribution to the fielding of the Ration, Light Weight, and the Ration, Cold Weather. These rations may help you complete your mission. Your data, comments and suggestions will be carefully evaluated and may lead to beneficial changes in the design and/or content of these rations. The data gathered in this study may be published in a scientific journal and contribute to our understanding of the physiology of man during exercise at high altitude in cold weather, and in response to sleep deprivation.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN (If volunteer is a minor)
PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS	DATE SIGNED

PART B - TO BE COMPLETED BY INVESTIGATOR *(contd)*

If you have any questions concerning this study or your results, you may contact Dr. Reed W. Hoyt, U.S. Army Research Institute of Environmental Medicine, Natick, MA 01760-5007, telephone number (617) 651-4802. All data and medical information obtained about you as an individual will be considered priviledged and held in confidence. Complete confidentiality can not be promised, particularly to subjects who are military members, because information bearing on your health may be required to be reported to appropriate medical or Command authorities, and applicable regulations note the possibility that the Food and Drug Administration and USAMRDC officials may inspect the records.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN *(If volunteer is a minor)*
PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS	DATE SIGNED

Reverse of DA FORM 5303-R, Apr 84

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